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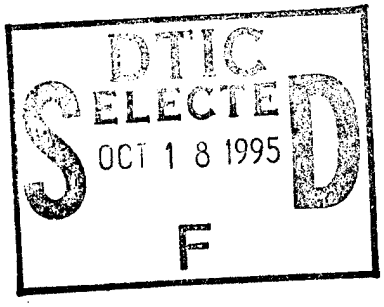
NAVAL SPECIAL WARFARE

SPORTS MEDICINE CONFERENCE PROCEEDINGS



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NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND
BETHESDA, MARYLAND

NAVAL SPECIAL WARFARE

SPORTS MEDICINE CONFERENCE PROCEEDINGS

May 4-6, 1994

Naval Amphibious Base

Coronado, California

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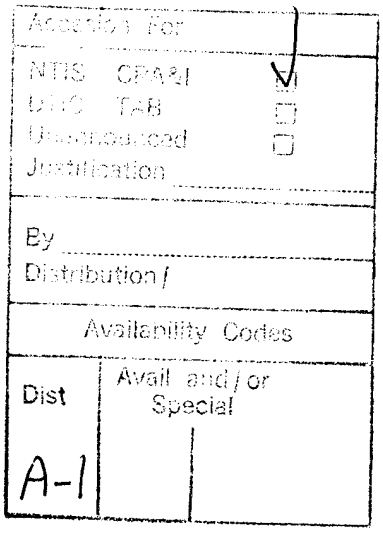

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EXECUTIVE SUMMARY

The first Naval Special Warfare Sports Medicine Conference was held May 4-6, 1994 at the Naval Amphibious Base, Coronado, California. The Conference was co-hosted by Commander Naval Special Warfare Command (COMNAVSPECWARCOM) and the Naval Health Research Center (NHRC), and funded by the Special Operations Research Development and Acquisition Center. The Conference was attended by Naval Special Warfare (NSW) operators (from East and West Coast commands), medical officers, researchers, and a panel of sports medicine specialists.

The Conference was initiated as an NHRC research project in collaboration with the Department of Sports Medicine, Naval Hospital Camp Pendleton. The Conference was convened to review the NSW calisthenic program and identify exercises thought to be "contraindicated," or likely to cause injury. Initially, NHRC researchers explored the scientific literature, but were unable to find any studies which identified specific exercises that cause injuries. There are inherent difficulties in conducting such studies because they require tracking thousands of people for several years, documenting all physical activities they perform and all injuries they develop. A more practical approach to the problem was needed. It was thought that a broader perspective of NSW calisthenics could be obtained by assembling a panel of recognized experts to review current practices and recommend modifications.

Representatives from the United States Olympic Committee, San Diego State University, United States Air Force Academy, Naval Medical Center San Diego, Naval Hospital Camp Pendleton, San Diego Children's Hospital, and Applied Futuristics composed the expert panel of sports medicine specialists, biomechanists, exercise physiologists, and certified athletic trainers. Armed with video tapes featuring a COMNAVSPECWARCOM brief and demonstrations of current NSW calisthenics, panel members arrived prepared to provide recommendations to improve both the safety and quality of NSW physical training.

The 3-day Conference was divided into two parts. First, a review of NSW calisthenics was conducted. Second, work-group discussions were conducted on selected topics in the areas of exercise science and sports medicine.

NSW Calisthenic Review

Panel members reviewed NSW calisthenics, weighing the advantages of each exercise against the injury risks, and made a decision to keep, modify, or eliminate each exercise. The panel also recommended exercises which may be added to the NSW calisthenic program.

Work-Group Discussion

Following the calisthenic review, participants divided into work-groups to discuss selected issues in the areas of flexibility and rehabilitation, strength training, and biomechanics. Work-group recommendations also included exercises which might be added to the existing NSW

calisthenic program, suggested physical training protocols and training tips, and injury-prevention guidelines.

This document is an edited transcript of the 3-day Conference. It includes: a section on the epidemiology of musculoskeletal injuries in NSW candidates and operators; a narrative of the panel's review of NSW calisthenics; stretching, conditioning, and injury-prevention recommendations; and the panel's general recommendations regarding strength and conditioning.

The panel's detailed recommendations regarding the review of NSW calisthenics will be available in a forthcoming NHRC Technical Document titled "Expert Panel Review of Naval Special Warfare Calisthenics Sports Medicine Conference Summary."

A second NSW Sports Medicine Conference is planned for FY96 to develop a physical training program for NSW operators. This program will be based on the panel's recommendations and review of the physical demands of NSW missions contained in a forthcoming NHRC Technical Report entitled "Physical Demands of U.S. Navy Sea-Air-Land (SEAL) Operations."

This document reflects the opinions of the expert panel and is not necessarily the official position of NHRC. The recommendations from this conference, and the second conference scheduled for FY96, will be combined to produce a physical training guide for NSW operators.

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I. WELCOME AND INTRODUCTION

JOE MOORE, CDR, MC, USN: My name is Joe Moore. I know most of you from talking to the different panelists on the phone and I'm real excited about everybody that's shown up today. I'm really excited about this conference. As far as I know, this hasn't been done before. We're taking a group of people from various backgrounds and bringing them inside what we tend to call "the box" - into the Navy box and looking at it from a different point of view. And, the time that we have is pretty short. I don't think we're going to revolutionize SEAL training, but hopefully it will give us a different perspective. We basically have just a couple of roles in these few days. One is we're going to review those exercises that were on the video, and we're simply going to decide whether we're going to make recommendations as to whether those exercises should be kept, or whether they should be eliminated, or whether some modifications should be put on those exercises. Secondly, you as a group and in your break-out groups, are going to decide what's the most significant aspect that you've observed in these last couple of days in terms of training, environment, type of terrain, the clothes they wear, the stretching they do, the strengthening they do or don't do, and some aspect that has struck you either as a group or individually and comment on those and make some recommendations to the group - something that we can take hold of. The areas that we're going to concentrate on are: strength training; biomechanics; flexibility; and we'll touch on rehab in one group. We're going to look at those aspects of training and decide whether some things need to be changed, modified, added, or deleted. Probably the last thing I think that really the goal is to network with one another and network with the community and really develop a relationship. I think this will help build a foundation that we can go back to. You as a group, you as a panel, the doctors that you meet, the operators that are here, to share information and really get into why some of these things are done. It's not like trying to train the football team in spring training, or the wrestling team. There really are other reasons other than just physical training, that bring some of this training to bear on the candidates. So keep that in mind, get into the operators heads, talk with the experts, in terms of the doctors and the people that you have around you, and really come to some idea in your own minds so that at future times we can call back on you and make reference to these things and use you as a resource in our communities.

Later on this morning we're going to have some hard and fast hands-on training over at the training area, and I'd like to now bring up Captain Butler just to give us a quick "welcome aboard," and then we're going to have a word from Captain Parks and Commander Morris.

FRANK BUTLER, CAPT, MC, USN: Commander Moore, thanks. For those of you I haven't met, I'm Frank Butler. I work for Admiral Smith at the Naval Special Warfare Command, coordinating the biomedical research programs that we look at for the SEALs.

I'd like to express the thanks of the Special Warfare Command for all of the panel participants coming out here. I think we have a great group and we're looking forward to your input. I can tell you that although we have about 20 or 30 research programs in various stages of evolution, this sports medicine program is absolutely number one on Admiral

Smith's list and he will be listening very closely to what you have to say. I'd also like to say thanks to Commander Joe Moore and Lieutenant Commander Lisa Meyer for setting up this conference. There is a tremendous variety of people here from very different types of backgrounds and we've got a lot of different perspectives on the problem - and I think that's excellent for looking at something that's as hard to get your hands around as this particular problem is. We're looking forward to your thoughts and what your observations are during the next few days. There are a couple of things to bear in mind. We're looking not only to minimize the injuries people suffer from doing these various types of exercises or calisthenics, we're also looking to maximize the training time. We've got a limited amount of time that SEALs can be out on the grinder or in the weight room doing PT and we don't want them to spend it doing an exercise which really doesn't have any big advantage for them. So we have to look at each of these exercises as an opportunity lost if it's something that's not really giving us a benefit for training. I look forward to meeting each of you in the next couple of days. Thanks.

CDR MOORE: Let me ask the participants and actually everyone in this room to just kind of give a thumb nail sketch of who you are where you came from what your line of work is and any thoughts you have on this course and some of the objectives you'd like to get out of it. Let's include the operators. We'll start back here.

BM1 LANCE CUMMINGS, USN: I'm currently at SEAL Team 4. I just came off a seven month deployment in South America. Right now I'm basically in charge of the sports training program at SEAL Team 4 and I'm an ACSM sports fitness director. That's basically my background.

JENNY STONE, ATC: I'm a certified athletic trainer. I work at the Olympic Training Center in Colorado Springs, and together with Ed Ryan, whom you'll meet in a few minutes, coordinate the athlete care at the Olympic Training Center as well as our other competitive events: US Olympic Festival, Pan Am Games, and Olympic Games.

BOB BEETEN, ATC: I'm the Senior Manager at the Olympic Committee Sports Medicine Program, overviewing the areas that Jenny Stone has just mentioned. Previous background prior to doing that involved athletic training, therapy, coaching baseball, primarily track and field, and at one time, I coached wrestling at the collegiate level. I think probably one of the things that I would like to get from this personally would be to collect an overview of where these people fit into a categorical niche, much like some of our athletes do in specialty areas to see what the needs are, how those are addressed, and what the end outcomes are. We're also particularly interested in what we call speeded-up rehabilitation programs where we're certainly anything but traditional in how we approach the topic. I'm here to see what's going on with these guys because basically they have the same objective we do I would imagine. When they're hurt they want to get back as quickly as they possibly can without the standard undue delays that normally take place in rehabilitation.

ED RYAN, ATC: I'm a Certified Athletic Trainer and Bob Beeten and Jenny Stone said it all.

KENTON KAUFMAN, Ph.D.: I came a long way. I'm from San Diego. I'm the director of the Motion Analysis Laboratory at Children's Hospital. The laboratory sees both children and adults and we deal with a spectrum of locomotion from "I can barely walk" to elite athletes. My background is engineering, and I've been involved with some of the work with the Navy SEAL Teams and overuse injuries. I look forward to working with you.

WALT ANDZEL, Ph.D.: I have a Ph.D. in Exercise Physiology. I'm the director of research at Applied Futuristics which is a company involved with sports performance and elite athlete performance. I'm also an Associate Professor at Kean College in Union, New Jersey and I direct the Exercise Physiology lab and a graduate/undergraduate program in adult fitness. I guess I'm interested in a couple of things. One is the physiological profile of the SEALs - What is this character all about - and more specifically about the role if any of resistance training on SEAL environment. Thank you.

MIKE WILLIAMS, COL, USMC: I'm the commanding officer of a Marine attack helicopter squadron at Camp Pendleton. I'm here in an unofficial capacity as an observer looking at this as a model for possibly developing similar training philosophy into the Marine Corps unit training programs. It's also a kind of personal thing of mine and it's not in any official capacity, but I would intend to generate something to propose to the Marine Corps out of this.

MR FRED KOCH: Dr. Andzel and I have developed Applied Futuristics. We come from the world of bodybuilding and the Ironman Magazine Training System. What we've done is we've developed and made popular the term Periodization of strength in exact sets and reps. The biggest problem with strength training we've found in history is that nobody's been able to tell you exactly what to do and when you overtrain exactly how much you overtrain. So the extent of strength training is to give exact numbers of exactly what you do every time you walk into a gym and with Periodization it sets up the protocol of what order you do things in sports and basically how to maximize your time and in what order to do it. What I'd like to see out of this conference is why strength training in the military isn't more of a predominant skill or objective that they use because it's been so involved with sports for so many years. My feeling is that it's because of the elite level of these people that they can't train in whatever mood they're in every day. This whole physical fitness thing of elite athletes is "I train as hard as I can everyday," but unfortunately, the body can't adapt to what the mind can push it to, and now you have your overuse injury problems. That's what Periodization has solved in strength training and in sports, and I'm looking forward to seeing how it can be fit in.

WADE LILLEGARD, MAJ, USA: I'm an Army Family Physician with fellowship training in sports medicine. I spent the last four and a half years at Madigan Army Medical Center developing a sports medicine program. I worked with the Special Operations group, Special Forces, and Rangers. My main interest in this issue is efficient training with low injury rates

and correlating the injury rates with training, and furthermore, coming up with some sort of a system whereby these soldier/athletes can be training out in the field with minimal equipment. I hope we can address some of those issues.

STEVE GIEBNER, CDR, MC, USN: I'm the Force Medical Officer at Naval Special Warfare. My interest is in what this group has to say when this is all over.

PETER FRANCIS, Ph.D.: I'm a professor in the Biomechanics lab at San Diego State University. I've been a consultant with the United States Olympic Committee since 1981. Here in town, I've had a steady stream of military personnel, including many of your physicians, through my graduate courses. So this is the culmination I think of several years of prodding and poking and encouragement and I see a breed of medical personnel anxious to fulfill exactly some of the requirements you folks have in mind. If there is any way the university can help, we certainly will.

COL JIM ROONEY, Ph.D., ATC, PT: I'm Director of Sports Medicine at the Air Force Academy. I'm a physical therapist. I have a doctorate in Sports Medicine. We oversee the strength and conditioning human performance lab at the Academy. My main interest here is, as Bob mentioned, maybe getting involved in some accelerated protocols, but mostly for injury prevention.

MR KIM GOSS: I'm the Assistant Conditioning Coach at the Air Force Academy. I work for Colonel Jim Rooney. I'm primarily involved in program design for the intercollegiate athletes (of which we have about a thousand) and I also help with the physical fitness training program at the academy. My main emphasis here would be to find ways to prevent injuries rather than having to rehabilitate them. The second thing would be to find ways to enhance performance.

AL MORRIS, CDR, USN: I'm the Director of Training at the Naval Special Warfare Center. I've been there now a little over a year in that capacity. My main interest here is just to see where all of us are coming from and to make sure that the way we're doing things now is represented and try to have as good a training as we can have without undue injury.

JIM PARKS, CAPT, USN: I'm the Commanding Officer of the Naval Special Warfare Center. I'm one of those guys that's been injured for the last 20 years and rehabilitated and injured again and I wish I'd met you guys about 20 years ago. I'm looking forward to seeing what everybody has to say, and I'm sure we're going to make some progress out of this meeting.

DAVE BEARD, LT, MC, USN: I'm the Senior Diving Medical Officer at Naval Special Warfare Center Medical Department. About half of our patient visits are sports related, primarily overuse injuries of the lower extremity.

DICK GUINAND, LCDR, MC, USN: I'm the Medical Officer at the Naval Special Warfare Group Two in Little Creek, Virginia. I'm one of three medical officers that take care of the four SEAL teams on the East Coast. Recommendations that come out of this meeting I will be carrying directly back to the East Coast hopefully to help better take care of the SEAL teams that are back there. In the upcoming years you'll probably see me applying to some of the graduate programs that you offer...

GARY GLUCK, LT, MC, USN: I'm a Diving Medical Officer at the Naval Special Warfare Center, and I suppose I'm one of the gentlemen in the trenches who will feel the direct effects of what comes from this meeting. I'm looking forward to hearing your recommendations and I hope to be a resource for sports injuries we see at the Center.

MIKE POWER, LT, MC, USN: I'm the newest Dive Medical Officer over at the Special Warfare Center. I've been here for about a month so basically I'm here to learn as much as I possibly can.

ROB MASON, LCDR, USN: I'm from SEAL Team 5. I recently returned from a six month deployment in Guam as Lieutenant Commander and I'm just waiting to go to a new command and I wanted to just check out what you guys had to say.

OS3 CHRIS HAMMOND: I'm also from SEAL Team 5. I just got back from a deployment and I'm just here to observe and check things out.

DAVID CHELSEY, LT, USN: I'm the Operations Officer at SDV Team One. I'm here to get smart on sports medicine but of particular importance to me is maximizing training time, preventing injuries, and ways to enhance your performance not only for working out but also before going into the field and doing missions.

BMCS BILL NEHL: I'm from SEAL Team 3 and I'm the PT coordinator on the missions.

HM1 TIM MACHULA: I'm from SEAL Team 3 Medical Department Representative. I'm just here to check this out and see what I can learn.

HM2 BRYAN LITTIN: I'm a corpsman at SEAL Team 3 as well. I'm here to learn as much as I can and pass it on to the guys in my platoon and hope to prevent injuries.

DUANE CANEVA, LT, MC, USN: I'm one of the medical officers at Special Warfare Group One here at Coronado.

CDR MOORE: Let me emphasize to the people in the back section. We need to pick your brains as much as you need to pick ours. You're the experts in your area, and we have some expertise, as you've heard, in different areas. So really the focus is to try to get some interaction and to maintain that interaction over the next couple of days because we can't do it in a vacuum and I believe that's the whole goal of bringing these people together here on

the base so that we not only find out how you do it but why you do it and the motivation behind some of those things.

I'd like to bring to the podium now Captain Parks to give us some ideas of further objectives in our group.

CAPT PARKS: Just again to extend my welcome to Coronado. I'm really happy to see such a qualified group of people here to look at Naval Special Warfare training. We're happy to have you look at the Center first. That's where all SEALs get their basic training and where most of them learn how to do exercises and that sort of carries on when they get to the teams although after they get to the teams the people sort of diverge and start doing their own program. I find your comment about weight training very interesting. We do have a new weight room over there. You ought to take a look at it and I think we could probably make some improvements in the way we weight train. We don't do a lot of weight training at the Center; it's mostly calisthenics, running, and swimming. Al and I were talking last night about whether we'd made any improvements in our weight training program in the last 20 years. I couldn't come up with anything yesterday, but last night I was thinking while I was lying in bed that we have made a couple of improvements. Hydration-wise, we make sure that everybody carries a canteen of water around with them and is hydrated. That's really important, especially during the summer. But thinking back 20 years ago, hydration then was a six pack of beer after you finish your workout. So that's one improvement. Stretching- we make sure everyone gets stretched out before they run. Again, 20 years ago stretching was just doing 500 flutter kicks to make sure you were warmed up before you took off down the beach. So progress has been made, not real fast, so I know we'll make some progress during this meeting. I'm looking forward to what everybody comes up with. If you have questions, Commander Morris as he mentioned, is my training officer, and if he can't answer them, we've got plenty of people at the center. I know we're not just concentrating on basic training but we're concentrating on training throughout the teams, but we do have sort of a focused group that you guys can look at while you're here. And like I said, if there are any questions or anything we can do to help you with your study while you're here, please let me know. Thank you.

CDR MORRIS: I'd like to take this opportunity to say that the Naval Special Warfare community has been very successful in providing to the fleet the kind of people that we needed. I think somewhere in the neighborhood of 87% of the people that we actually send over to the teams stay in the teams and of all of those people, an even higher percentage of them are very qualified and very capable in the areas that they choose to work in. As we look for improvements to the program and ways to make it better, my only concern is that we don't throw the baby out with the bath water. I'm not saying "don't change," but I'm saying that we ought to be very careful about the kinds of recommendations we do make so that we don't end up eliminating things that are working. It turns out if we focus on all the people that are injured and all the people who don't make it through the training, then sometimes we begin to forget about all the people who don't get injured and all the people who do make it through the training and where they go and what they've done for us in the community. I

want to make sure that there is also focus on what we're doing right over there and that gets emphasized as well. Something must be going on that's right because its worked for us for so many years.

What I've noticed in the BUD/S students that come to me for a medical roll, is that they haven't done anything in high school; they haven't done anything in college; they haven't done anything except play chess, golf, or something of that nature, all of those are good things to do, but it's kind of like if I decided to be a sports medicine expert and had never learned to read. I'd have no base to develop anything by. And that's where a lot of our injured people come from. Apparently, they've never built a base. Their bones aren't thick enough, dense enough, or strong enough, and so when I run them through the sand, they break. What I would like to see is to figure out how to build a base in these people or how we could find people who already have a base through the screening process. If I could bring people in who had the same base as the 30 guys who graduated the other day, I wouldn't have a problem with overuse injuries, at least at BUD/S - they might start occurring other places in the Teams. And for the schedule today. What I've done is I've invited anyone who's interested in going on a slow, soft sand run with me later. We have a lot of problems with soft sand, and I personally don't want to see soft sand go away. I run it just because it's a little bit harder of a workout than just running down the beach, plus it's a little more easy on my overuse injuries. Anyway, that's an invitation. It's scheduled at 9 o'clock.

Any questions for me?

DR ANDZEL: Just to raise a question...You're talking about being tenacious and going to failure in your exercise. Could you just identify the characteristics in an individual that you think are important to becoming a successful SEAL?

CAPT PARKS: I think what Commander Morris is saying is that there are two aspects of training: there's a mental aspect, and a physical aspect. Probably the mental aspect is more important in the final run, because that will really determine whether the guy makes it through training.

DR ANDZEL: What kind of traits are you looking for in this person?

CAPT PARKS: We're looking for a guy from training who won't quit. That's on the mental side. On the physical side, we're looking for a guy who will finish and be in real good shape at the end of 25 weeks.

CDR MORRIS: ...and make him physically more fit as well. If you could see the young men that come in at day one, and then see the guys that graduate, even in the tear-down process we apparently have there, these guys are just monsters. They're not on steroids, they're not on drugs, they have grown physically in a tremendous way. And a whole bunch more have been injured and have gone by the wayside.

COL WILLIAMS: They tried to pitch this through the Marine Corps a couple of years ago and we need to make sure we consider it in context. Sports training, yes, but that's not the mission. That's not why we're doing this. We're preparing someone to go into some very difficult combat conditions with combat stressors, and there aren't any real civilian equivalents. So you have to keep that whole thing in context. It's a two-fold thing. Physical preparation, but physical preparation not necessarily for sports competition, but for combat.

CAPT BUTLER: Let me add one extra dimension that is not immediately obvious to people who are first coming into contact with the community. We're really looking at two exquisitely different situations here. One is the people at the Special Warfare Center where Commander Morris will have a class that rolls in with 125 people, and will look to present a physical challenge, if you will, just for the challenge's sake...discomfort, just for discomfort's sake, in order to select which of those 25, 30, 40 guys we want to keep, and throw the rest of them back to the fleet. In that context, we have basically all day to make these guys miserable. We have an incredible amount of physical training time that we devote to these people. Most of the challenge in SEAL training is in fact physical. The mental toughness aspect of SEAL training is in overcoming all of these physical obstacles that Commander Morris places in their path. So that's one perspective. But when the guys get out of training, the situation changes dramatically. Now you've got a person who is a proven SEAL who has only about an hour and a half a day to work out. The rest of the day the guy is going to be out on a combat mission practice. He may be practicing patrol tactics, he may be on a parachute jump - but now you have a person that you have to go through and train with a very limited time each day to keep this person in shape. The other thing to bear in mind is that when they're at BUD/S, these people are training in groups of a hundred. So you've got to put a hundred people on the grinder and have them do something together. When they get to a SEAL team, the training can be much smaller - there are some training evolutions, but the potential is also there to break out into platoons, and do things in platoon size evolutions which is 10 or 15 people. So you really have two very different physical training things that we're looking at, and as you're looking at these exercises and the different training regimens, it's important to keep those things in mind.

CAPT PARKS: Just one comment, Captain Butler. I agree with what you said, but keep in mind, that 50% of the people that leave the program voluntarily quit. So it is a tough physical program, but I think it's mostly in their minds. More people could make it through physically than can make it through mentally. There's a mental state of mind where you say "I'm going to continue to do this until someone tells me to stop." So, going back to what I said earlier, there's a mental aspect and a physical aspect. They are going to be hard to separate sometimes, but you need to keep in mind when you're looking at an exercise whether it's a mental exercise we're giving them in being cold, wet, and miserable, or whether it's a physical exercise of running down the beach and getting hot.

MAJ LILLEGARD: Generally you start out with how many candidates per cycle?

CDR MORRIS: We started Monday with 99.

MAJ LILLEGARD: And you want to graduate a certain number?

CDR MORRIS: We want to graduate all the qualified...

MAJ LILLEGARD: Okay, so there's no end point that you're going to limit it to 30. It's whoever can make it.

CDR MORRIS: Whoever can make it. That's a real bone of contention that there are some people who believe that we drive the numbers to fit 30 people. But I'm convinced that if I had a hundred guys start today that had the base and the desire and motivation of the ones who just graduated, if I had the right hundred guys, none of them would quit, and it would be an easy class to train, and we wouldn't be worried about deaths or injuries, and my instructor staff would be just as happy as that. We spend an inordinate amount with medical injuries and DORs and "my cat it...," and "my wife, she...," and all the other problems that come up. If we didn't have that, then we would have a higher quality of training. All the instructors know that.

DR ANDZEL: How do you qualify for SEAL school?

CDR MORRIS: You take a screening test and it's a relatively simple screening test. It's a 500 yard swim in 12 and a half minutes, a mile and a half run in 11 and a half minutes. Push-ups somewhere in the neighborhood of 40 and 50 and the same with the sit-ups, and eight pull-ups. There's been discussions about changing that screen test up and down the realm. When I went through training, when it was much harder, the run was only a mile instead of a mile and a half (and we're talking about raising it to three), and there was a 300 yard swim. So there's been a few changes, but we haven't seen a change in how well the people do. We've increased the screen test a little bit but people still pretty much do the same. I think this goes back to what the Skipper was saying in that even a run down the beach is a mental obstacle. If you can't overcome that mental obstacle - all you sports people know - that pole vaulting and all these other things that people do, are mainly mental obstacles they have to overcome and train their bodies for.

MR RYAN: Is the swim test a test for time or is it just to make it?

CDR MORRIS: Time.

MR RYAN: Any stroke or is it crawl?

CDR MORRIS: It's underwater recovery. So you can do side-stroke, breast-stroke.

LT CANEVA: I just want to put a plug in for our side outside the Center. The attitude that you're describing or not describing, the people that make it through BUD/S this attitude carries over, and one of the problems that we see at the Team level is this attitude of working through the injuries. So they maintain this attitude of working to failure. So we don't see

them until they are failing, which in most cases, a lot of damage is done, sometimes, irreversible damage. So the end product that we're interested in from you is a sports medicine program geared not towards the professional athlete, but the professional soldier for combat conditions - something that is still high speed that they recognize that they have to go to early at the initiation of the injury when the injury first occurs.

MR GOSS: What are the common psychological characteristics of the candidates who quit? Are they conceited? Are they low intelligence, high intelligence..?

CDR MORRIS: They're just normal young men. They don't seem to have the physical base. A lot of them seem to be confused. They're rudderless, and that's on the majority that I'm talking about. Some of them do know that they want to quit but that's a minority number. Generally, it seems too hard to them. We had a Hell Week not too long ago that caused concern. 14 guys quit on hour 22. Hell Week is a week long process of basically sleep deprivation. They get all the food that they want, and we work them like dogs. We don't do anything different to them than we did in the pre-Hell Week period, but you have a psychological wall at 24 hours, and then you have a physiological wall of 48 hours of no sleep. As they were approaching the psychological wall at 22 hours, it had been a kind of a rainy nasty day, but it's Southern California, right? They were at chow. We had seven people quit at chow. They were doing no physical evolution. And then seven more quit at the hygiene inspection after. Granted at the hygiene inspection they did get a water wash-down with a hose to get the sand off them so the doctors could take a look at them, but I talked to all 14 of those men. They had all been thinking about quitting the week previous to starting Hell Week. So they don't have the emotional commitment to the program. Of those 14, none of them were injured. Although they said they were a little uncomfortable, none of them said they were cold. Some people would argue that they wouldn't tell me anything. They'd say "We're not going to tell you, Commander Morris." So just emotionally they just didn't have the strength that they needed.

BM1 CUMMINGS: Commander Morris I just have one question. It's been about three years since I was instructed there at BUD/S and Captain Butler was talking about after we get out of BUD/S and there's only about an hour and a half, and you get overuse syndrome and basically you're working with type A personalities who want to work through things. How much fitness and dietary principle training are you working into BUD/S now in the initial phases trying to educate these guys as to exactly what they're doing when they're out there?

CDR MORRIS: We've probably inserted a hundred different kinds of programs trying to fix the attrition, if you will. One of them has been the hydration that the Captain spoke of, and we've also added education about diet and nutrition in the pre-BUD/S course. Then we take them over to the chow hall and there have been attempts at the chow hall to make available to them potatoes and things more readily than some of the more fatty meat groups and things of that nature. However, I think that we're working with a cultural thing here. You get a lot of young 18-24 year old cultural male aggressive, testosterone, you know, kind of guys, and they're wet and sandy and miserable. When they get in that chow hall they're not in the

mood to compromise, if compromise was ever part of their life anyway. And they're not ready to compromise and select the greens and all these other low fat things. They want that chow on their plate and they want it in their mouth now, and they're not really too concerned. The hydration thing seems to be working, and that's probably because the instructors are standing over them every moment making them carry these canteens around - you'll see them over here pretty soon with their canteens and there will be water breaks during PT - something that's just remarkable to me. But that's what we do they actually stop and get to drink water. If you see them run forward and jump into an IBS to get washed off that's not torture. Here's what sometimes we do to ourselves is we get so introspective that we say "Geez you're getting them wet, you know, that's really torturing them, stop doing that." So we stop doing it. And guys start dropping like flies for heat exhaustion and heat stroke. And we go "God what happened? I've never seen heat stroke in the history of BUD/S training." But now we're seeing it all the time. So then we started throwing them back and when they can't do the flutter kicks anymore and they're starting to fail, and they're starting to look like they're going out on us, we say "Hit the IBS." They go up and get wet, it cools them off and gives them a chance to change which muscle group their using on the way up to the IBS. They get in, get out, and get back, and they actually can do things a little bit better for a while and they move on to the next exercise. We are giving them some training, but are they absorbing all of it? I don't think so. Second and third phase guys incorporate more of those kinds of things. They're the successful people. The first phase guys - a greater number of them are less successful.

DR FRANCIS: Is there an educational component of making sure that kids understand that simple things that go wrong are not necessarily giving up your manhood or anything. Actually the same kid who understands that a thousand dollars worth of school equipment is useless if you've got a tear in a three cent O ring - that same concept when you apply to the first signs of an overuse injury, it would seem you can overcome a lot of that with just simple, direct education. Is that part of the system? In terms of how things wear out - what basic anatomical structures are stressed?

CDR MORRIS: I don't believe so. At this point, what we do is we tell them that if they start to feel pain or if they're unable to perform, then they need to go to the medical facility. We have three doctors, four or five corpsmen, and a major medical facility for this command. That's in gargantuan contrast from when we had virtually nobody. You walked up and said "I have raspy breathing," they would tell you to hit the bay - that was sort of one mentality. We've come from that mentality all the way to providing a facility and an awareness for them to go and visit these people - the experts. The instructors are intent on performance. We're looking for performance, and we're looking for commitment by the man. When he starts failing for some reason, we pull him aside and we ask "What's your problem, son?" And he answers "I've got a patellar ligament syndrome" or something like that, that he picked up from his knowledge...and I say "Well, go see the corpsman." He may medically roll back. He also knows that he may medically roll out of training and be held in an HPE (Hold Prevent Enrollment) and then be put back into another class.

DR FRANCIS: What I'm getting at here is I see characteristics that are very similar. I've had experience with policemen and fire fighters. In this tightened group situation, they are very reluctant to tell anyone they're injured. It's letting their buddies down. In both of those cases I've made strong recommendations that it really doesn't take much education. A lot of these people will soak it up. They love learning more about themselves. It seems to me just a very introductory discussion at some stage that makes these kids understand what the early signs are and that there's nothing wrong with doing something about it in the early stages.

CDR MORRIS: Good point, we'll take a look at that.

LISA MEYER, LCDR, MC, USNR: Actually, I think that has more application once you get operational as Lieutenant Caneva was saying. Once these guys are educated, and they have a place to go to, and they know they're going to be taken care of and not taken out of the teams, I think your suggestion, Dr. Francis, might be more applicable.

CDR MORRIS: Are there anymore questions for me?

CDR MOORE: I think there's one more question in back.

LT GUINAND: Just another story on the same thing. It kind of points out what Captain Butler said. When you're in BUD/S and you're first reporting to the teams, and you're training enough to get into the platoon, there's a screening process. If you get injured, you can get dropped out of the program which they don't want. I have two guys I'm working on now, both who dislocated their shoulder in BUD/S, knew if they said anything, even if they said they needed a little bit of help, they're rolled back. So they relocated themselves, gutted it out, finished BUD/S, and when they got to their team they had a lot of training to do to get in a platoon, didn't have time to get rolled back, gutted it out, went on their deployment, and here they are now, after three years of being a SEAL, now they have the time to get fixed and they're coming to me for the first time. During those first few years you get hurt, but you can actually get dropped as a SEAL if you bring that injury up.

CDR MOORE: Some tremendous points made, and I think the big take home message for the people coming in is that the training is designed to do those things but it's designed to be safe. The vast majority of the people safely complete the training. I think safety is number one on everybody's mind. I think the panel members as you sit here and think about your own situation at the U.S. Olympic Committee, bodybuilders, Rangers, people that you deal with in the community, these kids aren't unlike anybody that we have in society. If they make it, they're goal directed, they can visualize completing this thing, they're team players - very much like the elite athletes. There are certain types of elite athletes - we were talking about the boxers who won't go to medical because it's a down chip. It's down time. Or the pilots who won't go to medical.

II. EPIDEMIOLOGY OF MUSCULOSKELETAL INJURIES IN NAVAL SPECIAL WARFARE CANDIDATES AND OPERATORS

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A. MUSCULOSKELETAL INJURIES AMONG NAVAL SPECIAL WARFARE CANDIDATES

Problem

Navy Sea-Air-Land (SEAL) candidate training at the Naval Special Warfare Center (NSWC), Coronado, CA, is one of the most physically challenging training programs in the military. This places SEAL candidates at high risk for sustaining overuse and traumatic musculoskeletal (MS) injuries. Determining the incidence, distribution, and impact these injuries have on readiness, training, and mission success is the first step toward developing and instituting effective preventive programs.

Objectives

The objectives of this study were to determine the rates and distribution of medical conditions and MS injuries incurred at the NSWC between April 1993 and March 1994 and identify risk factors which may contribute to MS injury.

Approach

A computer-based system was used to collect data on all trainees who were evaluated at the NSWC medical clinic during the study period. Diagnoses were categorized using the ICD-9 coding system. Injury was defined as any disability or complaint that required a visit to the clinic, involved musculoskeletal or soft tissue, and resulted from training. Incidence rates were calculated by determining trainee-months at risk, 100 trainee-months being equivalent to 100 candidates training for 30 days. Findings were reported in this manner because the high attrition rate at the NSWC causes the population at risk to fluctuate.

Results

Total patient presentations for all sick-call conditions occurred at a rate of 35.3 cases per 100 trainee-months. Diagnoses were split between medical conditions and musculoskeletal injuries, which accounted for 21 cases/100 trainee-months (most of them infectious diseases), and 14.3 cases/100 trainee-months respectively (Figure 1). Sixty-two percent of the musculoskeletal injuries were due to overuse.

The most common diagnoses of musculoskeletal injury were tendinitis (specifically iliotibial band), stress fracture, patellofemoral syndrome, periostitis and plantar fascitis (Figure 2). Sprains and strains were considered acute because they can occur in the absence of repetitive stress.

Discussion

The top five diagnoses are all in the lower extremity. All were due to overuse, and occured in the first few months of training. Given the NSWC training schedule, these injuries are most likely associated with running. Factors such as the duration, frequency and intensity of training, running surface, and footwear should be considered when assessing the cause of MS injury in this population. Further studies are needed to more completely understand the mechanism of injury, determine additional risk factors contributing to MS injury, and assess the cause of MS injury in this population. Minor changes in the training schedule are likely to decrease the number and impact these injuries have on SEAL candidates.

B. MUSCULOSKELETAL INJURY AMONG NAVAL SPECIAL WARFARE OPERATORS

Problem

The rigorous physical demands of Special Warfare training and mission performance place SEALs at high risk for sustaining overuse and traumatic MS injuries. Factors inherent in the operational setting (e.g., highly mobile population at risk, diversity of the SEAL mission, lack of centralized health care) not only make accurate assessments difficult, but also may increase the impact these injuries have within this elite community.

Objectives

The objectives of this study were to document the types of MS injuries occurring among SEAL operators, determine how these injures were occurring, and assess their impact on training. Issues regarding the use of health care facilities for the treatment of MS injuries were also addressed.

Approach

Data from the operational community was obtained from questionnaires completed in June/July 1993 by 413 SEAL operators, 197 from the East Coast, and 216 from the West Coast. Responses were limited to three injuries per operator. Due to complications associated with the subjectivity of the questionnaire format, specific diagnoses were not considered in the analysis.

Results

Respondent demographics included those with less than 5 years (60%), 5-10 years (18.5%), 10-15 years (12.2%), 15-20 years (6.6%), and over 20 years (2.5%) of operational experience. Operators reported a total of 644 MS injuries (Figure 3). MS injuries were classified into three categories: acute, overuse, and chronic (Figure 4). An injury was classified as chronic if it remained symptomatic, or if a re-injury occurred. When grouped by anatomical location (Figure 5), the majority of injuries occurred in the lower extremity (knee/lower leg 36.5%, ankle/foot 23.6%), and were associated with mission-related training (33.9%) or PT (47.9%) (Figure 6).

Injuries associated with mission-related activities were mainly acute (58%), and occurred in fairly diverse anatomical locations (Figures 7 and 8). Injuries associated with PT were mainly overuse (52%), and located primarily in the lower extremity (Figures 9 and 10).

Various outcomes related to injuries include limitations in the exercise program (31.6%), lost training time (25.3%), limited duty (23.5%), and negative effect on mission performance (11.6%) (Figure 11).

While assessing the patterns of medical facility use, we found platoon corpsmen were most often responsible for the initial evaluation of injury (Figure 12). Because of this, many injuries were never evaluated, or were evaluated at commands other than the cognizant Special Warfare medical treatment facility.

Operators reported overall satisfaction with treatment 75% of the time; however, when asked if they would utilize a sports medicine facility if it were available, 97% answered yes.

Discussion

This study indicated that the type of MS injury among Special Warfare operators tends to be evenly distributed among acute, chronic, and overuse, and were associated with PT and mission-related training.

Injuries associated with unit PT were mainly overuse and located in the lower extremity. The data suggest that these injuries are associated with, or exacerbated by, running. Overuse injury in this setting could be reduced significantly if minor changes in the operational PT program were made, and convenient access to appropriate health care professionals and rehabilitation facilities was provided.

Reflective of the diverse nature of the SEAL mission, injuries associated with mission-related activities tend to be acute in nature, and occur at many anatomical sites. Primary preventive interventions toward injuries that occur as a result of mission-related training are difficult to institute as they occur during training evolutions, and the mission can not be changed in order to prevent injuries. Improvements in equipment, such as the use of lighter materials or changes in footwear, may prevent injuries in the future. However, secondary and tertiary preventive efforts, such as proper screening, diagnosis, and treatment are crucial, and can not be ignored in this population. Acute injuries, although evaluated and treated at the hospital, almost always require rehabilitation to heal properly.

The discrepancy between the initial and final place evaluated (Figure 12) indicates that operators are being seen by several medical providers at various medical facilities before receiving definitive treatment. Definitive treatment, in many cases, is not provided by the cognizant medical facility. These findings may reflect the high mobility of SEAL operators. An acute injury occurring at a remote location would probably not be evaluated promptly nor by the cognizant medical treatment facility. However, this would account for only a percentage of those injuries associated with mission-related training. In other instances, delayed treatment may reflect a lack of available health care professionals and facilities. This is further substantiated by the data which indicate that the initial evaluation for the majority of these injuries was conducted by platoon corpsmen. The platoon corpsmen act as the primary medical provider, whether deployed or at shore commands. It is important to note that platoon corpsmen are SEAL operators first; corpsmen second. Their medical training is mainly in emergency medicine to treat acute injuries in the field. Diagnosing MS injuries relies heavily on effective clinical evaluation, which requires extensive training and

experience. Platoon corpsmen do not receive proper training for diagnosing MS injuries, and further, they do not have proper facilities to effectively treat these injuries. Placing the burden of diagnosis and treatment of MS injuries on platoon corpsmen delays appropriate treatment. If the goal is to decrease the frequency and potential impact these injuries place on training, readiness, and mission success, then accessible, consistent, efficacious rehabilitation is the minimum Naval Special Warfare Medical Departments should be providing.

Morbidity due to MS injuries includes limitations in exercise programs, lost training time, limited duty, and negative effect on mission performance. Further research efforts should focus on quantifying the degree of morbidity due to MS injuries and the impact of this on the Special Warfare community. This would include the number of lost training (or exercise) days, limited duty days, health care costs, and operational losses.

The even distribution of MS injury type (acute, chronic, overuse) suggests that these injures may represent a continuum. An acute injury, if improperly treated, becomes chronic. Chronic injuries predispose to overuse injuries, and overuse and chronic injuries make an individual more susceptible to an acute injury. Early and efficacious interventions (e.g., changing the training program, educating the SEALs, screening for injuries, providing prompt access to appropriate medical treatment facilities, providing accurate diagnoses, proper treatment, and consistent rehabilitation) could interrupt this cycle by preventing injuries from occurring, and allowing sufficient healing time for those that do occur. Lack of effective interventions results in decrements to mission performance, and could potentially lead to permanent damage.

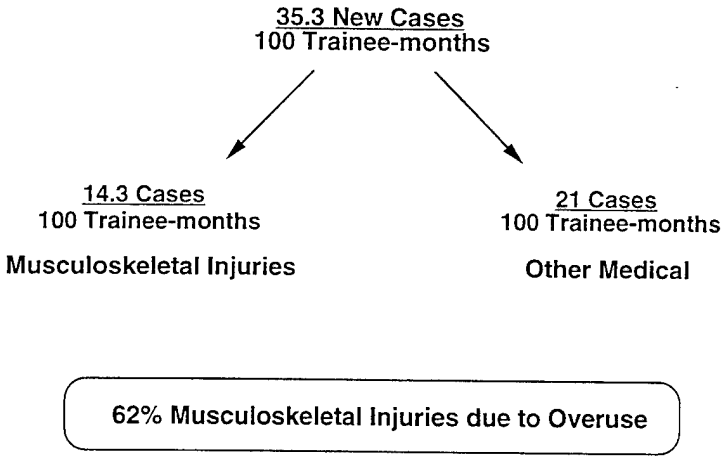

Figure 1. Incidence of musculoskeletal injury in SEAL trainees April 1993-March 1994.

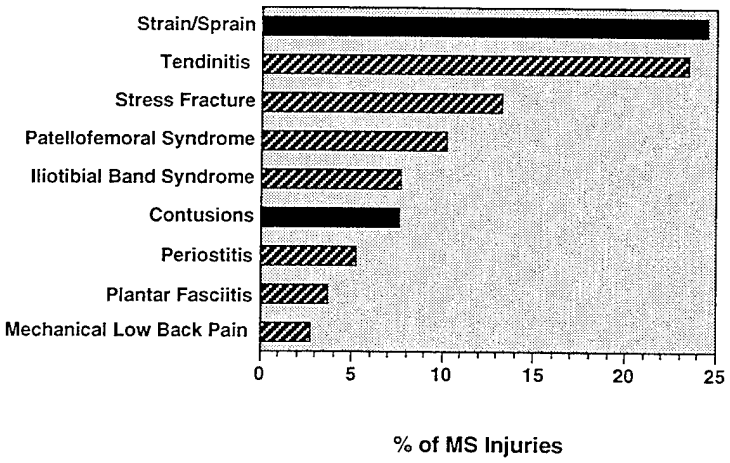

Figure 2. Percent of the most common musculoskeletal injuries in SEAL candidates April 93 - March 94.

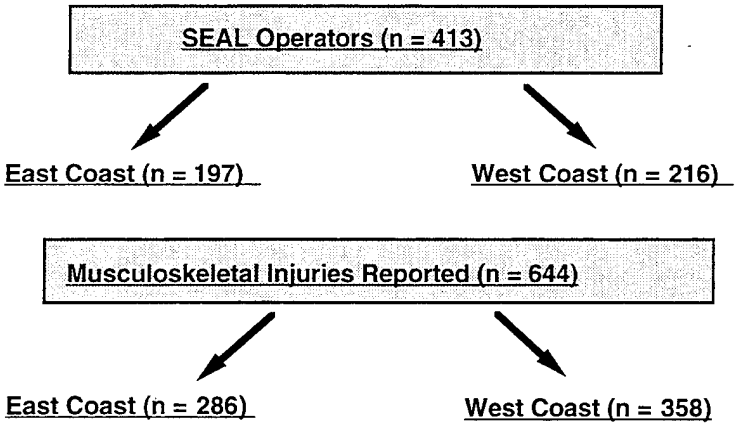

Figure 3. Musculoskeletal injuries reported by NSW operators.

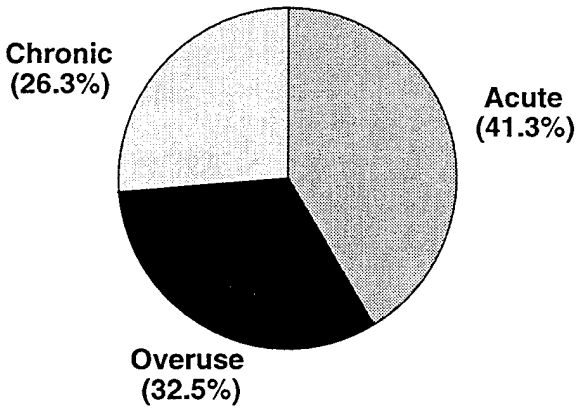

Figure 4. Type of musculoskeletal injuries among NSW operators (n = 554)

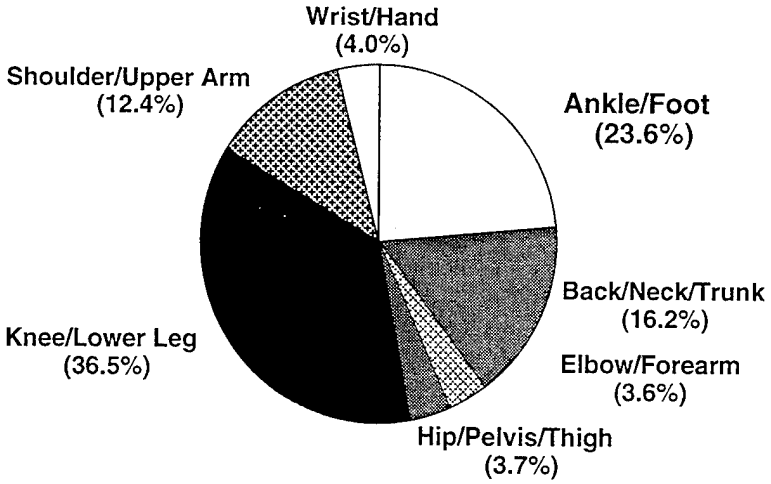

Figure 5. Anatomical location of musculoskeletal injuries in NSW operators (n = 554).

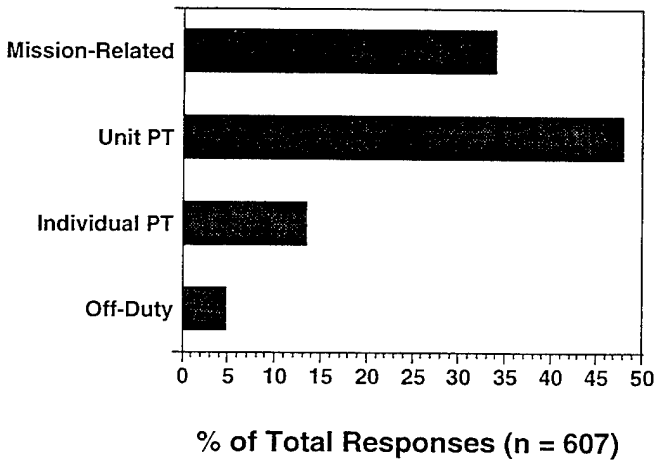

Figure 6. Activity associated with musculoskeletal injury among NSW operators.

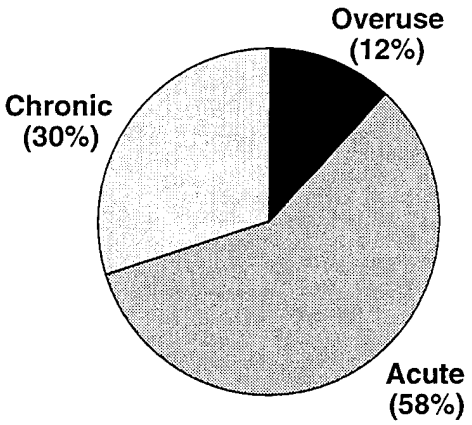

Figure 7. Type of musculoskeletal injury resulting from mission-related activities (n=190).

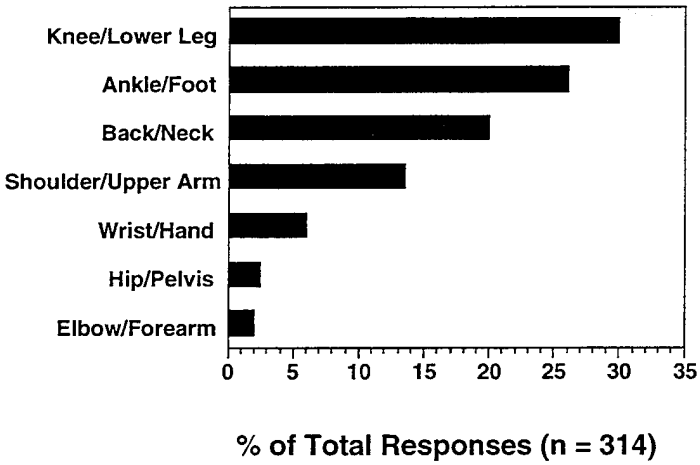

Figure 8. Anatomical location of musculoskeletal injury resulting from mission-related activities.

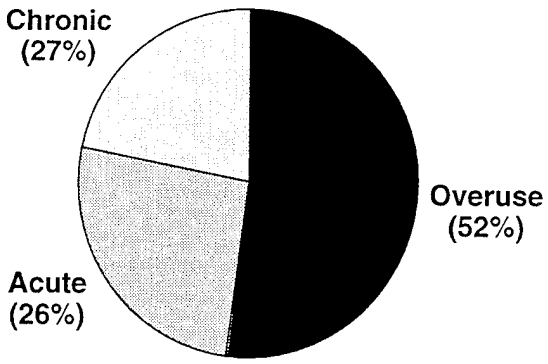

Figure 9. Type of musculoskeletal injury resulting from unit PT (n = 266).

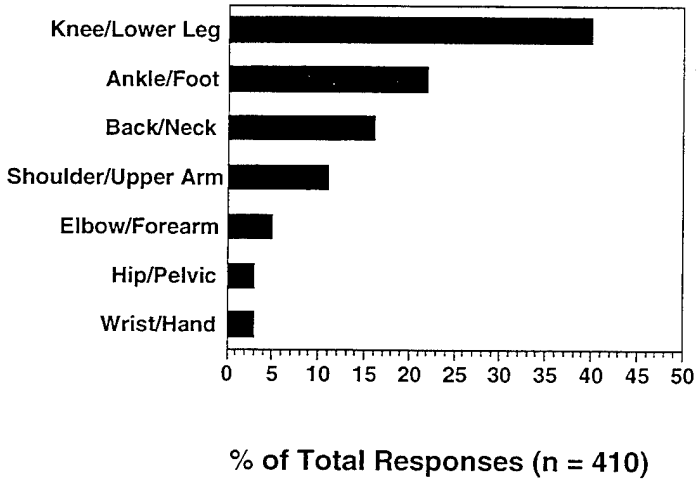

Figure 10. Anatomical location of musculoskeletl injury resulting from unit PT.

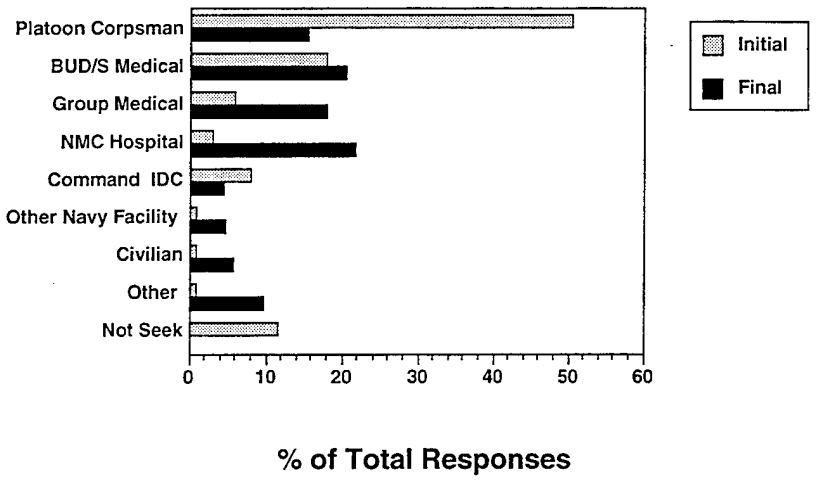

Figure 11. Initial vs. final place evaluated.

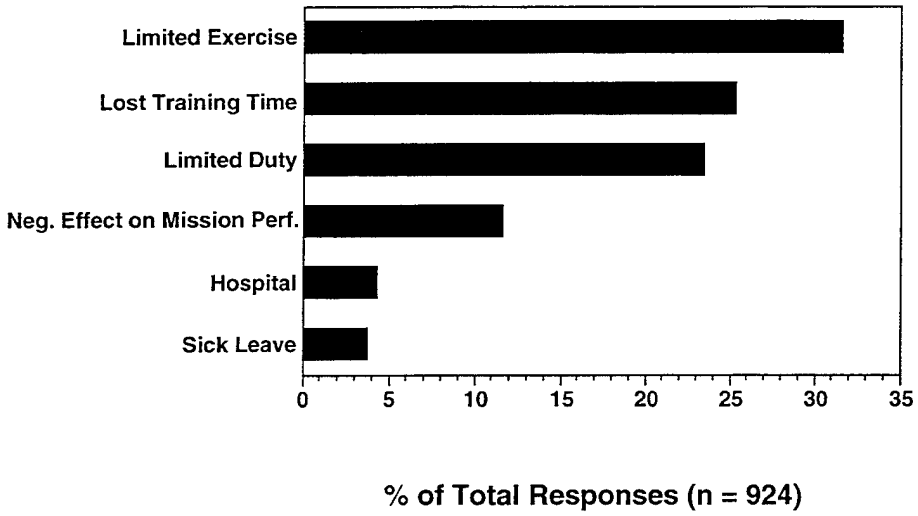

Figure 12. Outcome of musculoskeletal injury.

III. REVIEW OF NSW CALISTHENICS

This section contains a narrative of the panels review of NSW calisthenics. Salient points within the narrative are in bold.

A. STRETCHING

Please note: Many of the exercises discussed in the following are often performed ballistically, which is not recommended. Ballistic stretches, **in all cases**, should be performed dynamically using a controlled movement, without bouncing or jerking.

1. 2 & 4 COUNT WINDMILLS

Discussion Summary:

This exercise is best used as a stretching exercise (not as a warm-up) and should be performed slowly. There is a potential for injury to the back and vertebrae while bending over at the waist. If this exercise is to be kept, the panel recommended that the legs should be slightly flexed when performing this exercise to relieve some of the mechanical stress placed on the back while bending over.

Discussion:

CDR MOORE: We'll start out with describing them first. Strength versus flexibility...

MR BEETEN: It's sort of like ballistic.

MS STONE: You're not really going to the end of your range of motion either.

CDR MOORE: It's not end range. Aerobic or Anaerobic?

MR RYAN: Anaerobic. It depends on how intense you're doing these.

BMCS NEHL: We use it as kind of like a warm up or in between heavier exercise.

MR RYAN: Okay on the intensity it could be an anaerobic task. That would be the key factor. How fast you did these things.

CDR MOORE: Potential for injury?

MAJ LILLEGARD: **Any exercise where you're bending over statically at the waist increases your interdiscal pressure by 400%. I know most of these guys have young healthy backs, but it certainly puts the back more at risk or at least the disk.**

COL ROONEY: And doing it cold versus between other exercises when they'd be warm anyway.

CDR MORRIS: We usually start off with jumping jacks to get warmed up.

DR FRANCIS: I guess just as a guide, if it's a warm-up - we know that strength training and anaerobic exercise is mechanically stressful, whereas the warm-up is not. You don't get those benefits. So you want to minimize mechanical stress. I just want to reiterate that there's uneven pressure on the intervertebral disks. This means that you can warm up in different ways, there's no set pattern to it, and ideally, you want to minimize mechanical stress during the warm up. So there are other things that don't involve that acute spinal flexion and compression.

BM1 CUMMINGS: Just like any of the so-called stretching exercises here, they all have potential for injury, it just depends on the speed and the repetition. If you do one set of five repetitions, and you do them in two minutes, then you lower your potential for injury. If you get the stretch out of it, you're still using it as a filler between strength exercises, but you're getting a stretch and a flexibility out of it also. In the past, you've seen it used where you do 20 of them in 45 seconds and things like that. That's one thing you have to consider if you're the instructor up there how fast are you going to be doing them.

MS STONE: **You can certainly minimize the stress by having the people doing the exercise bend their knees just a little bit. Don't lock out your knees and hyperextension.**

CDR MOORE: **So you maintain that you might want to modify this exercise?**

MS STONE: **Yes, just flex the knees a little bit. That doesn't eliminate some of the stresses, but it reduces them.**

DR ANDZEL: Just to raise a question, the people who do these exercises, what is the purpose of them?

CDR MOORE: They just said they use it as a stretcher filler between more aerobic or intense anaerobic exercises.

DR ANDZEL: I just raised the question because when I played football 20 years ago that was a common exercise. We always thought we were working the hamstrings by doing it. It was really common. You also warmed up that way. There are so many exercises that seem like stretching exercises.

CDR MOORE: Does anyone vote to eliminate this exercise?

MAJ LILLEGARD: Well I certainly agree that there needs to be fillers between the strength work, and that's one of them, but is there a substitute or a modification that would do the same thing and theoretically decrease the stresses.

LCDR HOEKSEMA: The interesting thing is - you know I haven't seen this thing - but I bet we're going to sit here and see a lot of exercises that potentially put a lot of stress on the lower back. And yet the data doesn't hold that lower back problems are a big deal in the SEALs unless of course again, it's unreported injury. Guys have chronic lower back pain, but it's not bad enough to get them to a doctor until it gets severe.

CAPT BUTLER: One of the reasons that we're all sitting here in this room today is because we do have a lot of chronic low back pain. That's really the thing the precipitated this. On the East Coast, about 18 weeks ago, talking to some of the COs and the XOs and the Master Chiefs, guys who have been in the teams for 20 years, there seems to be an awful lot of low back pain. You're not going to see much chronic low back pain in these kids over here at BUD/S, but one of the things we're looking at is the cumulative effect of doing these exercises for 25 years day in and day out.

2. PRESS-PRESS-FLING

Discussion Summary:

There were no recommendations to modify this exercise.

Discussion:

CDR MOORE: Let's categorize it, flexibility versus strength?

PANEL: Flexibility.

CDR MOORE: What type of flexibility would you say?

PANEL: Ballistic.

CDR MOORE: Potential for injury? Relatively low, I'd say.

PANEL: Minimal.

CDR MOORE: Any anaerobic/aerobic contribution? Modify, keep, or...?

PANEL: Keep.

MAJ LILLEGARD: I would just think that with the external rotation that's going on that they should slow the movement down.

BMCS NEHL: It's usually not very intense. Again, this is filler.

3. HI JACK HI JILL

Discussion Summary:

There were no recommendations to eliminate or modify this exercise; however, there was some discussion regarding the ultimate value of this exercise to the exercise program.

Discussion:

CDR MOORE: Type of activity?

PANEL: It's pretty much the same (as the others). Yes, it's the same all across. Ballistic.

CDR MOORE: Potential for injury?

PANEL: Minimal.

CAPT CULLISON: The only person at risk in here would be somebody who's had a shoulder stabilization procedure, and most of those guys are going to self select any way. They're not going to put their recently operated shoulder back in flexion rotation as hard as they can so it's probably not a major concern. If it falls out, we'd probably like to know about it there as opposed to the mission.

DR FRANCIS: I think the real key there is it depends when in the training regime it's done. Basically, static stretching is the best way to stretch for people who have limited range of motion. If you've got good range of motion, you can maintain it with dynamic stretching. So if you're dealing with a deconditioned population, who have limited range of motion, I would say emphatically it's inappropriate as it forms another filler. Presumably, if they have good range of motion that's not that bad. **I question this exercise in terms of use of time and ultimate value to the (exercise) program.**

4. SWIMMER'S STRETCH

Discussion Summary:

Bending over from the waist, as in this exercise, puts mechanical stress on the lower back. This exercise is better done remaining erect or sitting down.

Discussion:

CDR MOORE: Type of stretch?

PANEL: Static.

CDR MOORE: Okay. Potential for injury?

MAJ LILLEGARD: Yes. **I voice the same sort of concerns as the initial exercise (we reviewed) as far as the back and disc aspects of the stretch. You could probably do the same thing standing up without bending over and stretching at the waist.**

CDR MOORE: Back injury? No? Keep or modify?

PANEL: Substitute.

CDR MOORE: I don't have a substitute category. Eliminate?

UNKNOWN: Captain Cullison, do you believe that a stretch like that, again over the course of a long career, could cause damage to the anterior capsule of the shoulder? Is that going to be bad?

CAPT CULLISON: Probably not. It depends on how much damage the person has and are they stretching out an already stretched shoulder. Most people - nobody's watching them do this exercise once they get out of BUD/S and if they have a shoulder problem, they're just not going to push as hard. So from a shoulder standpoint, I don't see the risk in it.

CAPT BUTLER: Presumably the stretching in these exercises is to prevent or reduce injuries, and I don't think we see that many overuse injuries of the upper extremities, do we?

LCDR MEYER: No we don't.

CDR MOORE: I think you're looking at shoulders probably.

LCDR MEYER: And it's acute.

CAPT CULLISON: We're also trying to prevent an acute injury from a rapid pull on a cold tendon. That's what you're also trying to do. So if you're about to do a bunch of pull-ups, and push-ups, and swimming and so on, I would strongly encourage shoulder stretching exercises to get it as loose as you can before you do the more powerful ballistic stuff.

5. UP, BACK, AND OVER

Discussion Summary:

It was decided to keep this exercise with no modifications.

Discussion:

CDR MOORE: Type of stretch?

DR ANDZEL: Back to ballistic.

CDR MOORE: Potential for injury?

PANEL: Low.

CDR MOORE: Maintain or modify?

PANEL: **Keep.**

6. TRICEPS STRETCH

Discussion Summary:

This is a good task-specific exercise. Maintain with no modifications.

Discussion:

DR ANDZEL: It's not directly related to the exercise itself...I just wanted to raise a question or maybe a point. In doing these stretching exercises, is there tracking of how many of these exercises you do? How long you hold the stretch, who determines the overload? Do you just go out there...

UNKNOWN: It depends on the guy leading.

DR ANDZEL: My point is this. With static stretching in reference to training overload the research that's out there recommends that you hold a static stretch for a certain duration. That's part of the overload. If the person goes out one day and holds it for 10 seconds, next day holds it for 5 seconds, and the next day he holds it for 40 seconds, how do you know where the overload is coming from? You're not tracking it at all.

CDR MORRIS: Good point. We don't.

DR ANDZEL: You don't have any idea. And the same thing if you do a ballistic movement. You feel good today so you do 10. Tomorrow you feel a little better and you do 15. Next day you feel lousy and do 10. Where's the systematic overload? See? That, I feel, needs to be addressed along with whether this exercise is good biomechanically or not. Maybe people who are dealing with flexibility need to address that question. I just wanted to raise that point at this time.

DR FRANCIS: **Just to comment on the last two - I think that they are good examples of task specific exercises. These folks are in the water, they're doing a variety of swimming strokes, you need a full range of motion and external and internal rotation. You're promoting that statically, which is the best way to do it. The previous one you could do just as effectively sitting down and take the stress off your low back. They're excellent exercises for what you're trying to achieve in an aquatics program. As far as stretching goes on the load, the only good controlled study that's ever been done shows that you get the same long term plastic effect in stretching with a 10 second sustained stretch. It's no better whether its held for 20 or 30 seconds. So in a sense there's no real overload beyond 10 seconds anyway. So an efficient use of time for most stretches is 10 seconds once you achieve the position.**

CDR MORRIS: That's helpful information if that's blessed and put on a piece of paper and then the teams can accept some of that stuff. They're doing it close to 10 seconds anyway.

LCDR MEYER: They are. That's written in the BUD/S manual by the way.

CDR MOORE: What were the findings on the triceps stretch? Was that a keep, modify, or eliminate?

PANEL: Keep.

7. PRESS-UPS

<u>Discussion Summary</u>:

This exercise serves as a passive abdominal stretch usually following abdominal strengthening exercises such as sit-ups. The goal of this exercise is not to fully extend the arms, but to stretch the abdominals. Therefore, the stretch should only be done to the point that the pelvis begins to lift off the floor.

Discussion:

CDR MOORE: Torso prone stretch?

PANEL: Static.

LCDR MEYER: It's usually done after sit-ups.

CDR MOORE: Okay, potential for injury?

DR FRANCIS: Can I clarify what he's doing? Is he getting there as an elbow extension exercise, or is this a passive thing where he's trying to stretch the lumbar spine in hyperextension? If it's the latter, it's fine, it's part of standard back maintenance programs. If it's being mixed up with a strength training exercise, where there's a lot of mechanical stress on the back, rather than a passive stretch, I think there's a little confusion about what you're trying to do there.

MS STONE: **Whoever's performing the exercise needs to be told that the point is to stretch the abdomen and keep the pelvis on the ground. If you have someone who doesn't have very good abdominal flexibility, they're going to be coming up - to use a ridiculous example - up on their knees. That defeats the purpose of the exercise so that is a stressor. That's doing the exercise improperly, and...**

MR RYAN: ...**therefore, full elbow extension isn't necessarily the goal. Performing the exercise until the hips or pelvis start to lift off the ground is the goal.**

CDR MOORE: What are we stretching here with this?

CAPT CULLISON: Generally you're doing this right after sit-ups, right?

LCDR MEYER: Yes.

CAPT CULLISON: So you're trying to regain your abdominal sensation. Generally you're not going to hurt your back too much because your abs are so tight that you can't move it enough to hurt it.

CDR MOORE: So there is some potential if the technique is done poorly. Keep it? Modify it?

PANEL: Keep it.

MS STONE: Modify the instructions.

CDR MOORE: Modify instructions?

MS STONE: Yes. Make sure it's done properly.

CDR MOORE: What becomes helpful is that I've been doing them all these years because 'he said to.' And so it's helpful with instructions because now you educate me and tell me why I'm really doing it, and that I shouldn't allow hips or pelvic area to come off the ground. I'm extending my arms because he's extending his arms.

8. TRUNK BENDING FORE AND AFT

Discussion Summary:

The purpose of this exercise is NOT to stretch the abdominals but to stretch the muscles that extend and flex the hips. Tight or over-developed hip flexors (i.e., iliopsoas muscle) play a major role in the development of low back pain. This exercise should be done with the knees slightly bent in order to decrease the mechanical stress on the vertebrae when bending backward (i.e., hyperextension).

Note: The iliopsoas muscle is by far the strongest hip flexor of the hip joint. It arises from the lumbar vertebrae and the inner aspect of the hip bone and inserts into the inner aspect of the femoral shaft.

Discussion:

CDR MOORE: Type of stretch?

PANEL: Static.

CDR MOORE: Is there a dynamic component to that?

MS STONE: You have to have the trunk control to achieve those positions.

MR BEETEN: Stabilization.

MR RYAN: **Minimal stabilization of the pelvis. I say its a good stretch. Everyone's iliopsoas is so tight by now.**

MR GOSS: I don't like the idea of arching the back. The sport of Olympic lifting knocked out the press exercise because of all the lower back injuries caused by that hyperextension at the top. Why can't you just come up perpendicular and then go back down?

BMCS NEHL: Because you're not really getting a good stretch on your abs that way.

MR GOSS: Well that's what the previous exercise - the torso prone stretch - was doing.

UNKNOWN: I don't have any problem with going back anyway, I think that's good. It will mobilize the lumbar spine.

CDR MOORE: So, are we going to modify or keep it as is?

PANEL: Keep.

MS STONE: Again, I think it's the instruction thing.

LCDR HOEKSEMA: **I would agree with elimination of the hyperextension** because if you look at sport-specific, I don't know of a lot of sports or even SEAL activities that involve hyperextension of the back. You don't get in that position. And secondly, the vast majority of mechanical lower back pain is not discogenic at least in my experience. It's so-called posterior elements. The guys with posterior element lower back pain, you put them in these two positions of back hyperextension, you're just going to aggravate them and boy are you going to cause lower back pain in a guy that might not have it in this extreme hyperextension position. SEALs are taught to do everything to the extreme. I think that persons like yourself might not go to extreme hyperextension in the back, but the majority of these guys, even that guy on the video, that guy was way back. That is not good for the lumbar spine.

DR FRANCIS: I think you have to examine all these exercises and ask what's the benefit; what's the risk. **This is one of those where I think the risk/benefit ratio is not conducive to its use, particularly that hyperextension. Modify it.**

MR BEETEN: **You can bend the knees and take that back arch out.**

CDR MORRIS: When you're talking about hyperextension, you're talking about this part here where it's arching hard?

DR FRANCIS: **Yes. But the load created by the weight of the body while bending backward, as well as the muscles on the front compressing the disk even more is something you won't see the results of immediately, but it's one of those cumulative problems.** I don't know why you want to accumulate more stress than you need. The return you get on the exercise is to replication. I think you could create other exercises that do the same thing.

CAPT CULLISON: What were you saying about free fall position?

CDR MORRIS: When you're in free fall position, you're strapped into a harness trying to hold you this way and you have to get a hard arch. It's brought up over and over again that you need a hard arch and that way you fall stable. As soon as you start to get your back above -then your center of gravity changes and you flip over on your back and now you're

falling back to earth. So you get a hard arch and flip back over. So you hold that, then you come in for a pull, and you go from a hard arch to a ejection. The opening shock jerks you right back up and so some people experience some back pain from being in a hard arch going into the position that you end up in a free fall.

DR FRANCIS: How much? I've done it. It doesn't hurt me as much as that. If you do it on the ground - with your belly on the ground - and do the same exercise, it becomes task specific with gravity acting in the same direction and there's a lot less stress. You don't have the load of the trunk pressing down on the back. Same effect, with less mechanical stress.

MR RYAN: **I would say that considering the fact that this was brought together due to a low back pain issue, anything that you can do to stretch the iliopsoas muscle (going from hip flexion, to an extended position) will be beneficial because probably if you look at all these people who have low back pain they have incredibly tight iliopsoas muscles.**

LT GUINAND: I definitely agree with what he's saying. As an osteopath, working with the East Coast SEALs - and I know Dr. Polland would have said the same thing here working on the West Coast - **the iliopsoas...plays a big part in low back pain and that's why when flutter kicks come up I'm going to attack those viciously. Stretching the psoas has tremendous beneficial effects for people with low back pain.**

MAJ LILLEGARD: I don't recall any specific good iliopsoas stretches in this. I don't know if any one else did. The one that was called the 'hip flexor stretch' really wasn't stretching the iliopsoas at all. It was more of a knee torturer..?

9. TRUNK ROTATIONS

Discussion Summary:

Perform this exercise slowly and with bent knees.

Discussion:

CDR MOORE: How would we classify these?

PANEL: Stretch.

CDR MOORE: Dynamic stretch? Controlled?

PANEL: Controlled ballistic stretch.

CDR MOORE: Potential for injury?

PANEL: Low.

CDR MOORE: Do you want to keep them?

PANEL: Keep.

MR BEETEN: **Bend the knees.**

CDR MOORE: Bent knee position?

COL ROONEY: **It would help if they paused longer too. They'd get more stretch out of it.**

10. TRUNK TWISTER (Standing and Seated)

Discussion Summary:

Perform this exercise seated rather than standing.

Discussion:

CDR MOORE: Type of stretch?

PANEL: Ballistic.

CDR MOORE: Potential for injury?

MR RYAN: I don't particularly care for rotating on a fixed knee. In fact if he would just go up on his toes it would eliminate that. Rotate on the balls of feet.

COL ROONEY: **It may be more effective for him to do it seated. Because then the hips wouldn't rotate.**

CDR MOORE: So the recommendation is to modify?

PANEL: Modify.

COL ROONEY: **You'd get the same effect you just wouldn't have that lower extremity rotating. Sit on the ground and do it. It would be better.**

11. TRUNK SIDE STRETCH

Discussion Summary:

The discussion contains a debate regarding whether this is a stretching or strengthening exercise; the consensus was that it's both. If the exercise is being performed to develop strength, then you need to overload the muscle (i.e., add weight). If the exercise is performed as a stretch, then it is best done passively, lying on the ground, and held for 10 seconds.

Discussion:

CDR MOORE: Type of stretch?

PANEL: Static.

CDR MOORE: Potential for injury?

PANEL: Low.

CDR MOORE: Modify or keep?

PANEL: Keep.

CDR MOORE: Comments?

COL ROONEY: You'd have to hold that one for 10 seconds so if that's what you're stretching...

CAPT BUTLER: In the trunk side stretch ...what overuse syndromes or acute injuries do we think that the trunk side stretch is helping us to prevent? It's great to be flexible, but we want to be goal oriented with these exercises.

MS STONE: Later on you're doing all kinds of abdominal exercises which exercise the obliques as well as the rectus. I think most people think that you should stretch muscles that you use to some degree or other and this is a way of stretching your internal and external obliques.

MR RYAN: If you're looking at ITB someone might say that you're stretching your hip abductors with that and that might help you out with your ITB?

MS STONE: And maybe if the benefit of the exercise has something to do with (as we talked before) between stressful exercises where the point of the exercise is to do something while you're resting instead of just laying on the floor or standing there or something. So the

point of the exercise really isn't to do the exercise. The point is of the exercise is to keep doing something. To keep your body in motion while you're resting.

CDR MORRIS: We thought that between our heavy workout exercises and the next heavy work out exercise, we were stretching out those muscles that we used and relaxing them a little bit before we went back in. That's what we thought we were doing. Generally working from the upper body, torso, legs.

CAPT BUTLER: Yes. Nobody is saying we don't need fillers, but as we're trying to decide between several alternative fillers, it's nice to know which are the ones that really give you your money's worth for your time spent.

DR FRANCIS: The only problem, though, is that you have to be clear as to whether it's a stretch or a strengthening exercise. If it's a strengthening exercise you need overload. If it's a stretch, it needs to be done statically. The problem with that is that you are stretching the muscle that's contracting actively. In other words, your abductors on the upper side are in contraction while you're trying to stretch them, and that's contradicting you in the exercise that you do. There is no other exercise where you simultaneously strengthen and stretch a muscle. So, if you want it as a strengthening exercise, yes, then it should be done up. If you want it as a stretching exercise, you get on your back and you rest the rest of your body while you passively stretch the abductors.

CDR MOORE: Is there any difference of opinion there?

COL ROONEY: The natural outcome of increased strength is increased flexibility. Because the tests performed at the 68 and 76 Olympic games showed that the olympic weight lifters were second only to gymnasts in measurements of flexibility. Olympic weight lifters, as a whole, do not stretch. So to say that we have to separate strength from stretching exercises, is nonsense. This will improve your flexibility. A lot of these dynamic types of stretches, as long as you have them under muscular control.

DR FRANCIS: It depends on the time that they're done. In the early stages I don't think it's a good idea to do dynamic stretching. When someone's got good flexibility, I think dynamic stretches help you to maintain that.

CDR MOORE: For the operators, a static stretch is one that we do in one position and you hold it. Dynamic stretch is one in which you have control over the range of motion of the joint and the muscle that you're not contracting. In other words, if I go up and stretch my hamstrings, I get control with my quads here. So it's a dynamic stretch. A controlled stretch in a range of motion.

12. BUD/S KNEE (ITB STRETCH)

Discussion Summary:

It was decided to keep this exercise with no modifications.

Discussion:

CDR MOORE: Static stretch. Problems with the ITB stretch?

MS STONE: Depending upon how the instruction is done, that can stretch your IT band, or it can stretch your trunk rotators. So if you're trying to stretch the IT band then you put more stress on the leg. If you're trying to stretch your trunk rotators, you need to rotate your trunk. You need to rotate and look behind you. It makes sense.

CDR MOORE: Keep it?

PANEL: **Keep.**

13. GROIN STRETCH

Discussion Summary:

Ample time should be given to get into position for this stretch so that it can be held for 10 seconds. The bent knee should always be aligned perpendicularly with the heel and should never exceed 90° of flexion. This stretch may be done upright so that the angle of the bent knee remains less than 60-90°. If more stretch is needed, the leg being stretched may be elevated as on the upward slope of a hill. Keep the foot of the leg being stretched pointed upward.

Discussion:

CDR MOORE: Describe the stretch.

PANEL: Static.

CDR MOORE: Potential for injury?

MR BEETEN: The more times you watch it, there's more to say. Does he hold it long enough, or doesn't he? He seems to bounce on it all the time when you really look at it. That's what you don't want them to do. **You want them coming down in fixed position, staying there for a 10 count and then come up, but don't be bouncing on it while they're down there.**

CDR MORRIS: It may be a common problem that we all have is that we all bounce on these things. I learned to bounce on them and then I was told years later that that wasn't good and that we were supposed to stop bouncing on them.

CDR MOORE: Adductors - types of areas that we're working?

LCDR HOEKSEMA: **We should have the foot pointed up. I think it would be a little bit more effective. Instead of the foot pointed forward if you had the foot pointed up I think it would be a little bit more effective and it wouldn't potentially injure the knee.**

CDR MOORE: Potential for injury?

MR KOCH: Just to make one point here on what you just said about bounce stretching and ballistic versus static stretching. Anything the SEALs do is ballistic. So all of their movements are into a ballistic range. Where we're coming from there's now some controversy about this whole static versus ballistic thing. Every movement you do is ballistic. The problem that I've been told is that a lot of people are just too lazy to warm up before they do ballistic stretching because static stretching - you're not going to get anywhere with it. How much range of motion can you get out of sitting there and holding that? Not much. Sure you can get some hold on it, but how many martial artists that we know since they live and die by getting their friends to jump on top of their shoulders, how many people do you know that get injured ballistically stretching? I think this whole scientific thing about static stretching needs to be reviewed because how many guys have gotten hurt ballistically stretching like that over time. If they're properly warmed up, I don't see any reason why they can't do that stuff because that's what you do when you're flying through the air on that obstacle course, that's how you land, you land ballistically, and everything you say is done ballistically. Why not train for it? The problem is you've got to warm up first for it. It's got to be properly done and the warm up becomes the key. Is the core temperature up enough where you can do these things. I feel that just from being in the real world, I've never seen anybody get hurt ballistically stretching. And every martial artist on the planet does it, and none of them get hurt from it. They never warm up - so I mean I'll stay away from that - but that's the point. I mean did you ever get hurt doing that after you were warmed up running doing it ballistically? I think this whole ballistic static thing is just..static stretching is the scientists coming in and saying well this is the way it looks like it should be. But in the real world, you know like they say in sports, what sport is static?

MS STONE: I think the difference is when you start looking at sports and looking at these stretches, when you look at sports, most sports are ballistic, I'll agree with that, but they're not ballistic at end ranges of motion where for the most part there are very few that are ballistic at the end range of motion.

MR KOCH: I know when you get to ballistic at the end range of motion is where you get hurt and that's where the stretch is supposed to be advantageous.

MS STONE: My point is, if you don't function ballistically at the end range of motion, then why stretch that way? And if you are ballistic in the middle range of motion, use your static stretch to expand that range of motion, and then train the muscle ballistically within that end of motion.

MR KOCH: So then you're still getting to the end range of motion because that's where you get injured.

MS STONE: No, but we're not doing flexibility. The whole reflex arc says that when you are at the end range of motion and put a sudden stretch on the muscle, the muscle spindles fire to reflexively contract the muscle.

MR KOCH: Right and that's what the scientist says. And in the real world, when you get out there doing an obstacle course, that's where you want to be the most flexible.

MS STONE: But you're not at the end range of motion.

MR KOCH: Sure you are. When you put your leg up on top of one of those - climbing up that thing- it looks like to me a lot of these guys are at the end range of motion. And that's where they need to train at is where you're down in that position and you're there, and that's what you need to increase that motion at the end range.
MS STONE: Are you getting hurt because you don't have motion at the end range or because you don't have ballistic strength at the end range?

MR KOCH: I don't know.

MS STONE: My point is that you get hurt because you don't have the strength at the end range. You have the range, but you don't have the strength at the end range. The control...

DR ANDZEL: ...that static versus ballistic in reference to postexercise soreness shows the same degree of soreness whether you did static stretching or ballistic stretching. Going back to the initial studies done by De Vries that started this whole thing on flexibility in 1962 which he introduced static stretching as a means of stretching sort of took off on the way we stretch, his original studies showed no difference in improvements of flexibility between static and ballistic. And yet we've continued on for 30 years and we still are with this argument should we ballistic or statically stretch? I think there are some valid points to be made for both groups. But again we have to look at our objectives and our purpose is to evaluate the exercises that we're choosing.

CDR MOORE: It is a controversial area and dynamic stretch comes in to play a lot of people now are going to complete the dynamic mode or modified dynamic mode of stretching. I don't know that we're going to solve it today, however, and I don't think it will be something that this group will solve.

CAPT BUTLER: What about the potential for knee injury on that last exercises, the groin stretchers? Because I've heard exactly what Senior Chief Nehl said repeated before in that a lot of people feel that this particular exercise causes problems with their knees.

CDR MOORE: In the contralateral knee you're talking about - the other knee.

CAPT CULLISON: It'll increase your patellofemoral contact and also let up the posterior horn of your menisci on either side. Some other things it'll you can do that are a lot worse than that. If they have a torn meniscus they're going to diagnose it doing that test. If they have a propensity for patellofemoral pain they'll exacerbate it by squatting on the flexed knee and putting all their weight over there. But in the larger scheme of things, I'd rather have them stretch their groin and beat up their knee a little bit than not stretch their groin.

DR KAUFMAN: **I think if they kept their knee over their heel there would be less potential injury on the knee.**

CAPT CULLISON: They're still going to have it flexed with their weight on it no matter how you do it.

DR KAUFMAN: It's still going to be flexed but it's going to be loaded more naturally.

MR RYAN: **I'm not sure that you necessarily jeopardize the knees by doing it without your hands in contact with the ground and that may even be advantageous as far as your trunk stability to do it in an upright position.**

CDR MORRIS: Back straight. We've done it both ways and we just changed at one point, I'm not sure exactly why but I remember there was some concern about knees and not really getting a good stretch because we were probably counting too fast. We weren't getting a chance to get down in the position and get the stretch before you were being told to go the other direction.

CDR MOORE: So if there is some suggestion to perhaps modify this? Or maintain?

DR FRANCIS: **The compression behind the patella jumps markedly at 60° of flexion and then it jumps even more markedly at 90° of flexion. You can overcome that jump by having the supporting leg on a downhill side or down on another object of some kind elevating the other one. So just as a guide for the instructors a 90° angle going beyond there - we know it as a significant increase in patellar pressure.**

CDR MOORE: A question of preventive instruction/modification of that?

PANEL: Yes.

14. HURDLER'S STRETCH (prone)

Discussion Summary:

This exercise should be renamed "quad stretch" to reflect the muscle actually being stretched. It is best performed from a seated position with the knee resting on the ground. The athlete should then lean back until the knee begins to come off the ground. Recommendations for a stretch that isolates the hip flexors are illustrated in the following discussion.

Discussion:

MAJ LILLEGARD: So that one's more like a partial quad stretch than a hip flexor stretch.

BMCS NEHL: I don't use them because they're supposed to be bad. They were always used in conjunction with the old hurdler's stretch. Advance forward, do a couple of hurdler's stretches, and then you go back and lay back on it. In a hurdler stretch you know you have one leg out and one leg back. You do a couple like that, and the final part of the exercise would be for you to lay back on it and stretch it out.

MAJ LILLEGARD: I would recommend substituting kneeling. Yes, that's more the quads...but for the hip flexor, just a kneeling hip flexor stretch.

CDR MOORE: Question to keep this?

MS STONE: **Well if you're going to keep the exercise then you instruct the person to lean back until their knee starts to come off the ground instead of laying back and trying to get the knee down. That keeps the ground supporting the lower leg.**

CDR MOORE: Could you comment on keeping the foot tucked in versus keeping it externally out to the side? Anybody?

DR FRANCIS: **There's a much more efficient hip flexor stretch that can be done on your feet - that's with one foot in front of the other and then with your weight on your front foot you flatten your back and then it isolates - it goes right to the iliopsoas and there's nothing else compromised. I don't know if you're familiar with it. I'll show you .. It's one foot in front of the other, you're shift your weight over to that foot, and then you flatten your back and isolate exactly the iliopsoas. There's nothing else uncomfortable or compromised.**

CDR MOORE: What they call hip flexors is probably quads?

PANEL: Yes

CDR MOORE: So with some modification. Does it matter whether its internal or external rotation of the hip at the leg at all? Tom, do you have any comment on that?

CAPT CULLISON: I think ideally, if you think about the patella, you probably want to keep it in neutral. You have the knee bent but there's no body weight on it so you don't have the same kind of patellofemoral forces.

CDR MOORE: Ms. Stone, let me make sure we understand what you said in terms of lying prone.

MS STONE: You're in the hurdler's position and instead of instructing the person to lay back on the ground, instruct them to lean back until they feel their leg coming up off the ground.

CDR MOORE: Did you say you wanted the toes pointed outward or back up under your rear end?

MS STONE: It doesn't matter. In theory, it would be nice to be able to keep things in a straight line, but some people don't have the ankle flexibility in order to do that.

CDR MOORE: Probably call it a quad stretch.

LCDR MEYER: So would you suggest replacing it..

CDR MOORE: We could probably keep it or with that modification?

MS STONE: Rename it and then add...

MR BEETEN: Call it a thigh stretcher.

LCDR MEYER: I think there's already a thigh stretcher.

CDR MOORE: A quad stretch.

15. BUTTERFLIES

Discussion Summary:

This stretch should be performed with a flat back. A recommendation was made to modify the exercise by grabbing the ankles instead of the toes to reduce the stress on the ankle ligaments.

Discussion:

CDR MOORE: Type of stretch?

PANEL: Static.

CDR MOORE: Area that we're stretching?

DR FRANCIS: Internal rotators.

CAPT CULLISON: And the adductors, the hip adductors.

CDR MOORE: Potential for injury?

PANEL: Low.

CDR MOORE: Keep it, modify it?

COL ROONEY: Do you perform that with your back rounded or with the back aligned?

BMCS NEHL: You're supposed to keep your back straight holding your feet together, trying to force your knees down to the ground. Guys flutter their leg, you can do that.

COL ROONEY: If a person has a rounded back while doing that will you come up and say "flatten your back"?

CDR MORRIS: We probably won't say anything to them. I don't think we recognize that there's a wrong way to do the butterfly.

CDR MOORE: Keep it?

DR KAUFMAN: How about a modification? **Instead of grabbing the toes, grabbing underneath the ankles so that you don't pull on the flexor retinaculum and the calcaneofibular, lateral talocalcaneal and deltoid ligaments of the ankle. Same exercise, but it makes a better exercise out of it. Instead of grabbing the toes like this, grab under the ankles like this, and you'll get the same effect but you won't stretch out the side of the foot.**

16. BACK BENDERS

Discussion Summary:

A name change to reflect the actual muscle groups being stretched (i.e., hamstring and adductors) was recommended. Additionally, the exercise should be performed with a straight back. The purpose is to stretch the muscles, not to touch your nose to the ground.

Discussion:

CDR MOORE: Type of stretch?

PANEL: Static.

MS STONE: Hamstring adductor stretch.

CDR MOORE: Everybody agree with that?

PANEL: Adductor.

MR BEETEN: **Like where he was doing it right there he broke right in the middle of the back. He does it appropriately where the back is straight, but then it becomes a different exercise.**

CDR MORRIS: Some of the guys can just lay right down on the ground. And others can't.

CDR MOORE: So we need a name change on this one?

MS STONE: **They need technique instruction, too, to keep the back straight and lay the chest forward instead of rolling and trying to put the nose on the ground.**

17. STANDING HEAD TO KNEE

Discussion Summary:

It was recommended that this exercise be eliminated. It can be more safely performed while seated or lying on your back. Please see recommendations under "Sitting Hamstring."

Discussion:

CDR MOORE: Type of stretch?

PANEL: Static

CDR MOORE: What are we stretching?

PANEL: Hamstrings.

CDR MOORE: What else?

PANEL: Low back.

MS STONE: **Seated is probably a better way to do that.**

CDR MOORE: Agreement there?

MAJ LILLEGARD: Yes. I think it's better to do what Ms. Stone was saying.

LCDR HOEKSEMA: Again, there are better ways to stretch your hamstrings than to put the stress on your lower back unnecessarily. I think you can stretch your hamstring with no stress on the lower back.

COL ROONEY: **If you put one knee up to your chest and do one leg at a time and stretch your hamstring and protect your lower back, you know if you're seated on the ground? There may be a way to modify that so you can stretch your hamstrings. . That's the way we teach people with low back pain to stretch their hamstrings.**

DR FRANCIS: **If you put a hand under the thigh it takes the compromise from the knee as well.**

COL ROONEY: So lay on your back like this and lean forward to stretch this hamstring. This flattens your low back and protects your low back.

CDR MORRIS: So that's less stressful than the standing one?

CDR MOORE: Do we eliminate this one then?

PANEL: Yes.

MS STONE: And modify the seated one.

CDR MOORE: Potential for injury for this one -- the seated?

PANEL: Medium or low.

COL ROONEY: I think, like we said, if you pull your other knee up toward the chest you protect your low back and you still stretch the hamstring.

CDR MOORE: Agreement with what Colonel Rooney is saying?

DR FRANCIS: **This exercise - on your back you don't compromise anything. Lay on your back, pull one knee from your chest and then try to straighten that knee. Actually so that your hamstrings and nothing else is involved.**

CDR MOORE: Okay. We'll put both of those recommendations down there. If we can remember what they were. So modify that.

18. CHERRY PICKERS

Discussion Summary:

This exercise should be eliminated because it has a high potential for developing back injury with little contribution to flexibility.

Discussion:

CDR MOORE: Static. Potential for injury?

MAJ LILLEGARD: Fairly high again. **That's another ballistic low back strain more than it is a stretch.**

MS STONE: If you're going to eliminate the Standing Head to Knee -this one is not a good idea either.

CDR MORRIS: So none of those bending over really strengthen your back?

UNKNOWN: Not really. No they don't.

CDR MORRIS: So practicing bending over all the time doesn't do anything for you?

MS STONE: Nothing except you have to activate those muscles to straighten your back up.

CAPT BUTLER: The other thing that needs to be mentioned is that the people in this tape are showing pretty good exercise hygiene, but there are a lot of people who do cherry pickers ballistically.

CDR MORRIS: Yes. That was the only way to do it. There was a definite bounce.

CDR MOORE: **Do I hear consensus to eliminate this?**

PANEL: **Yes.**

19. HURDLER'S STRETCH

Discussion Summary:

There were no modifications to this exercise.

Discussion:

CDR MOORE: Hurdler's stretch as demonstrated?

PANEL: Static.

CDR MORRIS: I've seen them do it with their leg to the outside also like you were really hurdling.

CDR MOORE: Potential for injury?

PANEL: Low.

CDR MOORE: Maintain as is, or modify? That versus the leg to the outside.

MS STONE: That's the safer way to do that.

CDR MOORE: Keep it?

PANEL: Yes.

20. SITTING HAMSTRING

Discussion Summary:

This exercise is best performed lying on your back, bringing the knee to the chest and extending it. If performed seated, it is best to bring the knee to the chest instead of trying to touch your nose to your knees.

Discussion:

MR BEETEN: We just talked about that.

MAJ LILLEGARD: Yeah, I think if you substitute the one Dr. Francis had mentioned, you can eliminate that one.

DR FRANCIS: You can get by with that if you have good low back mechanics, but for somebody that doesn't, that's very stressful on the lower spine.

CDR MOORE: Consensus on that? If we had one exercise to replace that - that would probably be a better one? Okay?

21. CROSS-OVER

Discussion Summary:

It was recommended that this exercise be eliminated as there are better stretches for this muscle group.

The relative merit of using various stretching exercises as "fillers" in between strength conditioning exercises was questioned. The consensus was that exercise in general should be preceded by a warm-up and followed by a cool-down. The warm-up exercise should be similar to the primary activity that is to be performed. For safer, more beneficial results, stretching is best performed as part of the cool down once the primary activity is completed.

Discussion:

CDR MOORE: Same thing... eliminate this one?

MR BEETEN: Unless you're going to use it as one of those fillers.

CDR MORRIS: We have to keep a few.

MAJ LILLEGARD: Yes, but we have enough substitutes there already.

CDR MOORE: Most of the hamstrings should be done either seated or supine. Any disagreement?

MR GOSS: **We would prefer to do all the static type of stretching at the end of a work out. Like on the football team all we do is dynamic types of stretching before we work out, and then we do all the static type stretching afterwards so it's not a competitive type of situation so they can relax and really feel the muscle. The problem is when**

you're going non stop and there's all this excitement going on and you're working on a stretch, sometimes it's hard to concentrate because it's a more competitive situation. We like to do it in a more relaxed type of situation.

CDR MOORE: Other comments on what Mr. Goss said? Do you witness that in other sports with elite athletes?

MR KOCH: What Mr. Goss said, from just a real world situation, stretching is boring. Guys aren't going to concentrate on it at the beginning of the workout when they're all fired up and ready to go. That's the same thing with holding the count. Even when you look at pro athletes on TV they're looking at the sky, and they're talking to their friends next to them. I don't know if that's the situation you have because it is a social environment. So I mean that's the realistic thing. Unless you have somebody who's really focused. He's ready to go. He doesn't even want to stretch to begin with, so he's going to use that stretching period to talk to the guy next to him or day dream, so if you have a movement to it, you're kind of fooling him into doing what's right. And then maybe you could use the static stretching as your cool-down because again, cool-down is a significant factor in conditioning an elite human machine.

MS STONE: Perhaps the flexibility group can address that.

COL ROONEY: Dr. Francis has talked about that a couple of times. **If you want to increase range of motion, do static stretches. Probably the best time to do it is after you've finished your work out and your muscles are warm and you're relaxed. As opposed to before you start a game when your objective isn't to increase your range of motion then. The objective is to get the muscle ready to perform.**

DR FRANCIS: I don't think there's a control issue that people think if you divide them into two categories. When I was out there this morning I didn't see anybody not paying attention. After that what I did see was some kids who were markedly tight in the gastrocnemius and the soleus. The last thing on the planet that you want to do is dynamic stretching for those tight muscles on those guys. When you get an adequate range of motion, if it's a functional range of motion then I'm all for it. It's a dynamic world. But what we're dealing with is imperfect bodies, fine tuning them, and throwing them out into stressful situations. You have two animals here, and I think that working with the BUD/S is different than working with dynamic situations. You don't want to lose good people.

MR GOSS: **Increases in the flexibility...that's a long term process. Doing a static stretch is not going to increase your natural flexibility right before a work out. All you're trying to do is get the blood going. I don't like the idea of doing a strenuous dynamic type of stretch and then sitting down and then here comes you're cooling off, and you're respiration is going down. Then you're going back up and down. I'd rather just make it a gradual warm up - making it increasingly tougher - and then do your primary activity. I just don't like the idea of going up, down, up, down...**

22. CHEST STRETCH

Discussion Summary:

This exercise is best performed in external rotation with the thumbs pointing up. Additionally, it should be combined with an exercise that stretches the posterior rotator cuff muscles. This can be accomplished by bringing the arm across the chest in front and holding this position for 10 seconds.

Discussion:

CDR MOORE: Next exercise.

MR BEETEN: Do you really do this one? You said you didn't do any two person stretches.

CDR MORRIS: Seldom. I don't believe we do this one very often.

DR FRANCIS: Was he internally or externally rotating? What I'm advocating is external rotation. Most people who get involved in strength training have tight abductors and they're internally rotated. You can tell when they try to shake hands with you, their thumbs are down. They're a little out of alignment. You'll see that, I'm not exaggerating too much. If you go to an externally rotated position, it is a very effective stretch. His thumbs should be up when he does it.

CDR MOORE: How about stress on the anterior capsule here, shoulder?

MR BEETEN: Can be.

CDR MOORE: Can be? Potential? If you ballistically force it or bounce it?

MS STONE: **If you're going to do that stretch, it's probably better to use the second person as your resistance and you control how much stress you put on your shoulder rather than letting them have control.**

COL ROONEY: So you lean forward instead of having them pull back.

MS STONE: Either that or you do it one arm at a time. So you're in this direction.

CDR MORRIS: Yes, I've done it on poles.

MR BEETEN: We've had swimmers tear out each other's shoulders.

LCDR HOEKSEMA: Especially a group of SEALs. All highly motivated, all trying to get the other guy to be just as perfect as he is. I would eliminate any team stretching.

MS STONE: Well you use the other person as a bar - they're an inanimate object at this point.

CDR MOORE: What are we stretching here...the anterior capsule and what else?

PANEL: Pecs.

MAJ LILLEGARD: **There are no stretches that stretch the posterior capsule on the shoulder. A tight posterior capsule would predispose someone to impingement.** I think the therapists and trainers would agree... that's one thing that should be addressed.

CDR MOORE: So would doing an extra arm rotation...

MAJ LILLEGARD: **Yes. Just do a cross arm posterior capsule stretch.**

CDR MOORE: That's a crossed adduction?

MAJ LILLEGARD: Yes, it should be added.

LT GUINAND: Just to throw something open here...you keep talking about ballistic and passive stretching. Do you not get more benefit on increasing your range of motion in stretching your muscle if you do it isometrically?

MS STONE: You mean contract-relax stretching?

LT GUINAND: Contract-relax increases the amount of stretch, contract against resistance relax...

MAJ LILLEGARD: Yes. I think that's fairly clear except, logistically, I don't know how that is done with any of these.

LT GUINAND: Some of these you could do that yourself, such as the chest stretch. If you're up against a pole you could contract-relax.

MAJ LILLEGARD: But to teach a large group of people to do that safely and correctly is difficult.

23. STANDING CALF STRETCH

Discussion Summary:

This exercise should be performed using a tilt-board at a 35° angle. Additionally, it should be performed both with the leg straight to stretch the gastrocnemius, and slightly bent to stretch the soleus.

Discussion:

CDR MOORE: Comments...

DR FRANCIS: If he's stretching his calf muscles, if he's focusing on his gastrocnemius and soleus..these knee movements, they kind of switch the gastroc in and out and put the stress on the soleus when you have knee flexion. As long as there's no stress on the back to do it. What you're doing is you're switching from the primary target - which is the gastroc with the knees extended... when you flex and break a little, you go to the soleus. Some of these guys need it. Especially if they work out in heels a lot. You know with a heel on the boots you've got, you're going to have tightness in the calf muscles.

CDR MOORE: **Do I hear consensus to move to a better stretch and eliminate this one?**

PANEL: **Yes.**

CDR MOORE: You're talking about the standing calf stretch?

DR LONG: Yes. A tilt board...at an incline.

LCDR FEYH: Yes. We have the incline boards, I don't see why they can't use them. They're underutilized anyway. You build them, you send them over there, and nobody ever uses them.

MS STONE: **And that's what they should be using.**

CDR MORRIS: Right, I understand - you stand on the board with your back against the wall and it forces your toes up to a 35° angle or something like that. You're stretching your calf prior to a run. Is that what you're talking about?

PANEL: Yes.

CDR MORRIS: Yeah, we just don't have them on the PT grinder. Now in a team it might be a little easier.

MR RYAN: You should do that standing. When they go over to do their pull-ups, chin-ups, and upper body stuff...

LCDR MEYER: **And what about the added stretch to include the soleus?**

MS STONE: **You just do it with a bent knee rather then with a straight knee.**

LCDR MEYER: Okay, make sure you get that in there...the soleus stretch...

CDR MOORE: **So include the soleus. What you're talking about - bending the knee - is getting the second portion of the calf. You can always stretch that well by bending the knee.**

24. BACK STRETCH

Discussion Summary:

This stretch should be done with the legs bent up to the chest, removing the weight from the cervical spine.

Discussion:

CDR MOORE: What are we working here? Are we working back muscles? Anything else?

MS STONE: Extensors.

CDR MOORE: Comments on this. Potential for injury?

DR FRANCIS: Cervical spine. If someone already has -- it's not uncommon among people who are strength training to start to lose some of the curvature in the cervical spine and adding a load to that - I didn't see many neck injuries in your data, but there was a bit of a shift in some stages to spinal injuries.

CDR MORRIS: Once they get older.

LCDR HOEKSEMA: You actually see a fair amount of cervical radiculopathies. It's not uncommon.

MS STONE: There are better things to do.

CDR MOORE: Eliminate?

PANEL: Yes.

CDR MORRIS: What we think we're doing is stretching out our back.

MS STONE: You need a chest stretch or rotational stretch.

LCDR HOEKSEMA: If they lay on their back and they don't get all the way up to where they're stressing their cervical spine...by curling it and just keeping their knees bent so they're not stressing their lower back - you can do the same thing just by curling up. You can still stretch your lower back muscles. It's in a good position because they're on their backs. So a modification instead of elimination. Because so far this is the only safe back stretch I've seen.

MS STONE: Well maybe it's a modification of how to get in and out of that stretch as opposed to the stretch itself. **Instead of getting into it and out of it with straight legs, get into and out of it with bent legs.**

CDR MOORE: **Can you grab your knees and rock on it?**

MS STONE: **Sure.**

HM2 SANDSTEDE: One alternative to the exercises that we teach in physical therapy is to have the patient on their knees with everything on their heels and just lean forward and relax the spine and lean forward - and curl over themselves. Just kind of roll up in a ball, like a fetal position.

CDR MOORE: Next one.

25. THIGH STRETCH (2 Person)

Discussion Summary:

It was recommended that this exercise, in its current form, be eliminated. A recommendation was made to perform this exercise standing, alternating one foot at a time, using the same hand with the same foot keeping the knees parallel and under the hip.

Discussion:

CDR MOORE: What are we getting here?

PANEL: Quads. Hip flexors.

CDR MOORE: Potential for injury?

PANEL: Low.

CDR MOORE: Modify, keep?

DR FRANCIS: **Stand up, one foot at a time - your heel to your buttocks. It will do exactly the same thing...take the stress off your supporting knees, take the stress off your cervical spine and lumbar spine as well. Just stand and use same hand with same foot, and if you want to add a pelvic tilt you get rectus femoris in as well.**

CDR MOORE: So eliminate this and just do it standing.

PANEL: Yes.

MS STONE: We're just unloading the weight bearing on the knee - on the patellofemoral joint.

MAJ LILLEGARD: Shouldn't you cross the other arm over so you prevent the torquing of the knee outward?

DR FRANCIS: Most people, if you watch them from the back - I've seen hundreds in exercise classes doing it, but there's more stress crossing your hand than using the same side hand. So just anecdotally, the number of people who do it incorrectly in large groups, it's kind of a toss up, but I think it's probably better with same hand and same leg.

MS STONE: **And just instruct people to keep their knee underneath their hip.**

DR FRANCIS: **And keep their knees parallel.**

CDR MOORE: We're almost done with flexibility and then we'll call it a day. Last comments. I misspoke earlier today, what we intended to do and what we'd like to do with the operators is we'd like to get you together in a group so that we can use you as a forum. There's a time for that in the afternoon. For the panelists we'd like to get the panelists together and kind of mull over this independently and bring their questions to the operators. We'd still like the operators to be in the area if we have questions, but initially when we break out, we'd like the panelists to get together and then we'd like a separate panel with the operators.

B. CONDITIONING EXERCISES

1. JUMPING JACKS

Discussion Summary:

No modifications were recommended for this exercise.

Discussion:

LCDR MEYER: The first one was the jumping jacks.

CDR MOORE: Jumping jacks in terms of type of activity?

PANEL: Aerobic.

CDR MOORE: Potential for injury?

PANEL: Low.

CDR MOORE: Modifications? Keep, modify or eliminate?

PANEL: **Keep.**

CDR MOORE: Comments?

UNKNOWN: I'd just like to make a point again with adding to the duration of the activity and intensity - jumping jacks can be an anaerobic activity if you do them at a faster count.

CDR MOORE: Now is that true of all the aerobic activities?

UNKNOWN: That's right. Same type of thing.

CDR MOORE: Next.

2. NECK ROTATIONS

Discussion Summary:

This exercise could be better accomplished using some form of resistance such as a hand, towel, etc. It was also suggested that the exercise be done lying on the stomach so that the neck extensors are conditioned.

Discussion:

CDR MOORE: We saw these yesterday, neck rotations? Is there an aerobic or anaerobic component to them?

PANEL: Flexibility.

CDR MOORE: Potential for injury?

UNKNOWN: If its done uncontrolled it would be high but it's more moderate.

UNKNOWN: How about done over the lifetime of the SEAL? or in the face of an old injury or osteoarthritis?

MS STONE: If its a strengthening exercise, then I think there are better hand resisted exercises that you can do that accomplish the same purpose.

CDR MOORE: So you would say to modify this?

MR BEETEN: Yes. If you're going to use it for strengthening, it ought to be adapted.

CAPT BUTLER: The question that came up over here is...maybe you do use it to strengthen your neck to carry IBS in BUD/S, but how often do you carry boats on your head after you get out of SEAL training? Not very often. Also, with no resistance except gravity, how much strength benefit do you really get?

BMCS NEHL: You to keep your neck up for even carrying a rucksack or anything else like in a parachute jump...or if you go out in a body position and you're snapped in the wrong position you could snap your head back. I use them in my PT program. I don't do a lot of them, but...

CAPT BUTLER: What do you use for neck strengthening for football players and body builders?

COL ROONEY: We use isometrics more than that type of exercise... where there's resistance in all planes and try and strengthen the neck isometrically.

MS STONE: And you can basically do it with your own hand so you don't need a partner or anything.

MAJ LILLEGARD: You can take a towel and put it over your head, and use the towel as resistance...or a shirt...

CDR MOORE: Does the benefit of modifying this outweigh the risks of injury that you may obtain if we kept it the same?

UNKNOWN: We also need to consider the time component. To do the isometrics would take considerably more time than what they're doing in there.

UNKNOWN: I agree. I think these are very useful especially for parachute landings when you're contracting your neck muscles to keep your head off the ground. The neck rotations certainly would be better to do at multiple angle isometrics, but that takes a fair amount of time to complete.

COL ROONEY: But once out of BUD/S they could start it.

MR RYAN: Are neck rotations ever performed in a position other than supine?

CDR MORRIS: They can do them standing or supine.

MR RYAN: They can also be done prone. There's no neck extension in that exercise.

CDR MOORE: So you don't get any extension in the neck?

BMCS NEHL: Not going back - because you're lying on the deck as it is. You go back like this and you're supposed to be raising your head a couple of inches off the deck.

CDR MOORE: My question is, can you do it prone?

COL ROONEY: I think it would be beneficial because we're talking about muscle balance and those other things. In the long term that's where you run into problems where you're just exercising one side.

MR RYAN: **Certainly not as a replacement, but you're doing neck rotations on your back - flip over and do them on your stomach.**

MS STONE: If you want to add something you could do side lines too - I mean you just go 1, 2, 3, 4 the whole way around the circle.

COL ROONEY: Keep that one and add to it in terms of what you do with your neck.

CDR MOORE: Okay, next.

3. DIVE BOMBER PUSH-UPS

Discussion Summary:

No modifications were recommended for this exercise.

Discussion:

CDR MOORE: Any particular problems with the Dive Bombers? It's strength building, aerobic. Potential for injury?

PANEL: Low

CDR MOORE: Comments on that. Any modifications? Any other suggestions?
PANEL: Keep

4. TRICEPS PUSH-UPS

Discussion Summary:

No modifications were recommended for this exercise. A discussion regarding muscle strength vs. endurance is contained in the following text.

Discussion:

CDR MOORE: Aerobic and strengthening. Potential for injury for this exercise?

PANEL: Low.

CDR MOORE: Would anybody modify it? Comments?

MR KOCH: You define strength here and I'm sure we'll take it up more in the group, but push-ups are not considered more of a strength exercise than muscle endurance. I think a lot of the things with calisthenics and that type of exercise is that people define them as strength but they're not considered strength exercises, they're considered muscle endurance exercises. So there's a real clear definition - at least in our terms -of which is which. So I mean that's something obviously we'll be taking up later, but when you go through this, I think that we should recognize that these exercises are not strength exercises.

DR ANDZEL: In your definition you're using the term "maximal contraction" one time and everybody is talking about those as being strength exercise. We're talking about the end result that you are going to gain strength - you have no measure of strength now - you don't

measure strength at all in any of your evaluations. You have people do push-ups, you use muscle endurance as a key to performance - it's how many push-ups you can do.

CDR MOORE: When you do a triceps push-up aren't you recruiting muscle fibers?

DR ANDZEL: You are eventually probably going to gain some strength, but the key thing is you're gaining muscle endurance. The ability to contract that muscle over time.

DR FRANCIS: I think it goes back to status. If you've got some of these BUD/S who can't do a dozen of those, then it's a strength exercise to do three sets of those, or ten or whatever it is. The transition after that you sort of plateau out and you're working on endurance. But your clients are endurance athletes. There's nothing wrong with muscle endurance if it's involving some of the activities they do in their work.
DR ANDZEL: Then call it muscle endurance.

MS STONE: You can change the intensity of those exercises by having them do those exercises with a ruck sack on their back or elevating their feet. You could also do it by having them do a hundred repetitions, too.

MR KOCH: That's not strength, that's endurance. We'll go into it later. It's just your definition of strength...

CDR MOORE: We had tanks on their backs.

LCDR MEYER: The GAO investigated them and found that it was causing stress on the back.

MS STONE: They could do that with a partner couldn't they? Have a partner hold the feet up and you wouldn't need any more equipment.

CAPT BUTLER: Should we put that in the report? That you can put the dive tanks back on?

5. PUSH-UPS (wide, standard and narrow arm placement)

Discussion Summary:

Push-ups should be performed first with the arms outstretched gradually moving to a more narrow stance. This avoids fatiguing the triceps prior to fatiguing the pectorals.

Adding a "push-up with a plus" was highly recommended. This modification involves adding an extra push once the arms are fully extended thus engaging the shoulder muscles.

The importance of grip strength was discussed. Suggestions to improve grip strength include fingertip push-ups, running with a ball, and rope-climbing.

Discussion:

CDR MOORE: Push-ups...Ditto for all of these?

PANEL: Yes.

CDR MOORE: Low. Keep it.

DR FRANCIS: **Just an additional comment. There's something to be said for push-ups as an abdominal exercise, but it's not well recognized. In a functional range of motion if you do push-ups correctly, they are an excellent abdominal exercise especially at the low end.**

CAPT BUTLER: What about the relative merits of those three types of push-ups? I mean would we necessarily want to keep two sets of each or four or five sets of regular push-ups? How would you mix and match those exercises?

MR KOCH: **To close with your hands in is more triceps. As you go out its more chest, so what you would talk about is the planning and the order. You would do the outside ones first. If you do the inside ones first you're going to tire out the triceps more. That way when you move your hands out, your triceps become the limiting factor. The problem with the push-up is that it's mostly a triceps exercise unless you're wider out where you can try to eliminate some of the arm movement. So yes, there is a benefit of doing all three of them. There are other ways you can add to that too.**

MR BEETEN: Just a question...Basically, most all of the exercises in this total block of things, there's very little except for doing pull-ups where you're getting any forearm strength. **If you go up and do a finger tip push-up here you can use that in addition to make this exercise a little tougher, but you'll start to get some forearm strength out of it. So I would suggest finger tip push-ups. They're harder, more difficult, but you're going to**

gain some forearm stuff which you don't do in any other exercise except when you're doing pull-ups.

COL ROONEY: Or even do them on their fist too in a transition. That's what we do for forearm strength and then they can work up on it.

CAPT BUTLER: **One of the things we were talking about during the break yesterday is that maybe the single thing that we use the most is grip strength.** When you're coming down these fast ropes that you saw on the video, you have 200 pounds worth of SEAL and 50 pounds worth of gear. If your grip strength is not what it ought to be, it's going to be a very quick trip down for you. **Are there additional things that you might suggest as grip strengtheners that we don't see here?**

MR KOCH: **Just run with it.**

MS STONE: I've seen it done in the obstacle course and other places...rope climbing.

CDR MORRIS: We have rope climbing in there. I don't know if anyone noticed. I didn't really point it out. But when we walked out the back gate there were several ropes for rope climbing...that gives them some of that strength...

MR KOCH: **When you go for a run, you always have something in your hand.**

COL ROONEY: The pull-up itself that they're doing is really a lot of forearm strength that they're getting even though they may not be fatigued.

CDR MOORE: Rubber ball, rope climbing, fingertip push-ups...

CAPT BUTLER: Those are some things that you may want to put in the report, too, with some additional emphasis on grip strength development.
DR FRANCIS: **There's an additional variation on push-ups that's hard to see...but if you go through the last few degrees of movement of the shoulder girdle it's a shoulder abduction exercise. It has important significance in a lot of functional activities. Instead of just going to elbow extension, abduct and adduct the scapula so you alternate between a push-up and an abduction exercise. It adds another dimension.**

COL ROONEY: They call that a "push-up with a plus" in the literature.

UNKNOWN: And we do that with our shoulder rehab.

CDR MOORE: That's for scapular stabilizers?

DR FRANCIS: Serratus anterior specifically.

CDR MOORE: You find all your winged scapula guys then.

MR KOCH: Find the guys who want to increase their push-ups. Like when you get into a position where you just can't do another push-up and you can't feel it - that's what that weakness is. That is the limiting factor in the number of push-ups you can do. So if you work those, it'll actually make your push-ups go up. Because that's the stabilizer for the push-up. The exercise you're talking about, that will make your push-up numbers go up. So in other words, that's the stabilizer muscle for a push-up. Once that goes up, your push-ups will go up.

6. PULL-UPS (wide, standard, and narrow grip, behind back)

Discussion Summary:

No modifications were recommended for these exercises.

Discussion:

CDR MOORE: So pull-ups...the wide grip, narrow grip, and behind the back pull-ups. Potential for injury on any of these? Any reason we should not keep any of these?

DR FRANCIS: Just a suggestion on the proportion of them. Everything I saw on the obstacle course seems to mirror the kind of things I would perceive your folks doing in a combat situation. Most of the forearm activity is done in a pronated position. Ladder climbing, wall climbing, ascent onto vehicles and so on - is done in a pronated position. In the supinate position, the chin, you rely much on - you recruit biceps very forcibly. But in the other position you're working very hard on brachialis and brachioradialis so in terms of proportion, I would do more of them in the task specific position than in the supinated position.

LCDR MEYER: They do more pull-ups than chin-ups.

CDR MORRIS: They do more pull-ups than chin-ups, generally. In times past, it was pointed out that you can't climb a wall by shoving your hand through it and pulling yourself up. You have to get up top and pull yourself this direction.

DR FRANCIS: They still have their place because you pick up two scuba tanks and you're in a supinate position.

CDR MORRIS: The equipment we pick up and loading things...you're going to use those other muscles. It's just that for the obstacle course...One of the questions I had about this - it's not shown on here, but it is practiced - is that you will go to failure and then you may

be four or five short of your goal and so a guy will grab a hold of your ankles behind you and give a light rise just so you can continue to pull to do that.

UNKNOWN: That's great. I saw that yesterday.

CDR MORRIS: So buddy assistance is okay.

MS STONE: When you're rope climbing it's a similar type exercise but in a narrow position.

7. CHIN-UPS

Discussion Summary:

A discussion regarding the importance of back strength and grip strength in the operational setting follows. The consensus was that chin-ups are an important exercise for developing back strength while pull-ups are a better exercise for developing grip strength. Suggestions for variations on the chin-up and pull-up to improve back and grip strength are contained in the following discussion.

Discussion:

CDR MOORE: Comments on the chin-ups? Less task specific.

MR KOCH: But still valuable.

CDR MOORE: Keep them?

PANEL: Yes.

CDR MOORE: Potential for injury for any of these? If done correctly.

MR KOCH: To back up one step on the chin-ups...My only comment would be you're still working more back when you're doing chin-ups and pull-ups - you know your lower lats - and when you pull-up with a pack or something on your back even though your hands are in the opposite direction, it may be beneficial with the chin-up because again its more. What weak link fails during the chin-up may not be the same weak link that fails when you're doing a one shot over a wall type force movement. That would be the only reason with chin-ups...because you're working more biceps. When you do a task it becomes a whole different world than just doing exercises like this. So that the chin-up is really beneficial because of the work it does, because elbows are in close to the body like when you're pulling up on a wall with one hand. It may not duplicate what your pull-ups do.

CDR MOORE: Other comments?

CDR MORRIS: We climb a variety of ladders, too, where you'll reach around and pull yourself up.

MR KOCH: When you grab with one hand you're pulling - a lot of times with weight on - you're pulling straight and you're pulling more down here which is more even a duplication - not elbows out here. So when you're doing a task, a lot of times the back becomes a movement - and plus your hands from holding on to the weight - like we talked about with the grip. **When you're doing pull-ups, the weak link may be that forearm muscle and your hand grip. It may not be the back that gives out. So it's not task specific because of the fact that you don't pull-up with a pack ten times.**

CDR MOORE: So there are some isometrics there.

UNKNOWN: **It's a different movement pulling with a pack versus doing pull-ups. So the chin-up is important for that lat strength.**

CDR MORRIS: We essentially use five different positions on the pull-ups. We'll do the three that you've shown here, plus behind the neck and also lock our hands over the bars...that simulates going up a caving ladder whereas you're climbing the side of the caving ladder and putting your heels into it and climbing straight up like that. So that duplicates that action. Just putting your hands over it and locking your fingers in and pulling yourself up on both sides touching your chin each time.

CDR MOORE: Wide narrow behind the back interlocking, and what was the 5th?

CDR MORRIS: Normal.

MR GOSS: **It might also be beneficial to do a lot of movements with more of an open hand - by adding athletic tape around the bar so that you're gripping more with the open hand type of grip. One reason that some people - judo athletes for example - can't transfer the strength in the weight room into the actual arena is because a lot of the gripping they do is more with the open hand. To give you an example, there's a judo athlete in Canada who weighed about 110 pounds, could do five pull-ups, and what the trainer did was had her on a program of five sets of five twice a week for six weeks. The only difference that she did as far as variety was adding a piece of athletic tape every work out so that she was gripping more and more with the open hand. After six weeks she was doing five pull-ups with 45 pounds strapped to her waist. So, in addition to varying your grip, just maybe have some thicker bars that they could be using.**

DR ANDZEL: Is there a progression to do like an obstacle course or the obstacle course in gear?

CDR MORRIS: In BUD/S we do it without gear. During Hell Week there are some low obstacles that they do with their clothes, but that's not really the same thing.

DR ANDZEL: That's more functional I would imagine.

CDR MORRIS: The guys in the teams will do that from time to time. The obstacle course is seldom run with gear on.

BM1 CUMMINGS: Basically the course...it simulates a lot of the conditions that we do but we use it to build agility and speed. Anaerobically between each obstacle and aerobically running it once and then running it again backwards. You use all of your grip strength there.

DR KAUFMAN: There was some talk yesterday about shoulder injury. I think the wide grip pull-up has more potential for injury of the shoulder than any other pull-ups.

CDR MOORE: Any grip more injurious? I mean any stance?

DR KAUFMAN: I think the wider would have more potential for injury to the shoulder.

CDR MOORE: If someone has impingement to begin with, it ought to be self limiting.

MS STONE: With that particular position, you're in a little more adduction external rotation. As somebody gets tired they could potentially - as they drop down - dislocate their shoulder. But that's kind of a fatigue/loss of control situation also.

HM2 SANDSTEDE: So, there's a potential for injury if someone's had a prior dislocation or something when they're hanging at full extension. The musculature no longer provides integrity for the joint and you're relying on the ligaments that may have already been injured, or you're increasing a stretch on those ligaments. We teach in physical therapy to come just before full extension - don't quite go all the way down.

MS STONE: If somebody dislocated their shoulder they won't hang that way.

HM2 SANDSTEDE: ...the way the muscles are recruited constantly throughout the motion.

8. SIT-UPS (hand to toe, elbow to knee/legs bent, cross-overs/legs bent)

Discussion Summary:

A lengthy but important discussion follows regarding the merit of these abdominal exercises. The consensus was that many exercises, mistakenly thought to be abdominal exercises are in fact hip flexor exercises. These so called "pseudo abdominal" exercises do not effectively develop abdominal strength. Any abdominal exercise that lifts the mid or low back off the floor engages the hip flexors. Any abdominal exercise in which the legs remain 6 inches off the ground (i.e., Hello Darlings, Flutter Kicks) are hip flexor exercises.

There are several problems with this misconception. The first is that the abdominal muscles are not sufficiently strengthened. Exercises which specifically strengthen the abdominals should be incorporated into a physical training program. Abdominal strength is best developed by exercises performed within the anatomical range of motion. This is best accomplished by placing a roll in the small of your back so that the exercise is performed from a slightly extended to a slightly flexed position. The movement is a small one and should be done slowly. Quality is more important than quantity. The hands can be placed across the chest or behind the head. If placed behind the head, care should be taken not to flex the neck or pull the head to assist the lift. Concentration on using the abdomninals through the whole range of movement is essential. The abdominal exercise when performed correctly is actually a small concentrated movement.

The second problem occurs when the hip flexors become overdeveloped. Strong hip flexors are necessary but overdeveloped hip flexors not only change the curvature of the spine but also contribute to lumbar disc degeneration. The result? Chronic low back pain and vertebral disc disease. Over developed hip flexors can be avoided by incorporating exercises which strengthen the hip extensors. Exercises which strengthen the hip extensors are outlined below and in the appendices.

The panel recommended that hand to toe sit-ups be eliminated because they place mechanical stress on the back and do not exercise abdominals. Elbow to knee exercises with legs bent are preferred.

Discussion:

CDR MOORE: Let's look at these three: hand to toe, elbow to knee, and the cross over. Potential for injury for any of those?

MAJ LILLEGARD: **The hand to toe one is...I'm not sure there's any utility to that exercise which the other ones don't cover, and certainly you're almost forced to exaggerate lumbar lordosis with that exercise.**

PANEL: Yes.

CDR MOORE: So the main potential is the back.

MAJ LILLEGARD: Right.

MR BEETEN: **It's not an abdominal exercise anyway.**

CDR MOORE: Is there a consensus to eliminate that one in the face of the others?

PANEL: Yes.

CDR MOORE: Elbow to knee? Preferred?

PANEL: Keep it.

CDR MOORE: And the obliques - Problems with those? Keep those? What are we working - for completeness sake - ? Abs? And in the cross overs anything else?

DR FRANCIS: That whole area is really wishy washy if you look at the internal/external obliques they create - one of them creates rotation in one direction, the other one creates rotation in the other direction so that the recruitment of what you're doing is no different no matter which of those sit-ups you do. All you're doing is kind of alternating. **But I think the real key issue on sit-ups is speed. I think its quality of crunches, curl ups, rather than the quantity. If you look very carefully at people doing them quickly, its an exercise for sternocleidomastoid (neck muscles) and pectorals (chest muscles). They're literally throwing their elbows and head. It's the inertia of all of those body parts that get them up. You have to isolate the abdominals and use them slowly and effectively because in the real world they are used isometrically. So I think the traditional way of doing as many as you can in unit time puts stress on the neck, puts stress on the back, and it really doesn't accomplish what you set out to do. So I would shift the goal towards the quality of those sit-ups and I think the cadence has to go down.**

CAPT BUTLER: What about the two technique points - straight leg versus bent leg sit-ups? The people who devised the Navy PFT don't allow you to put your hands behind your head because they're convinced that you're going to pull yourself up like that and strain your neck in the process. So, you actually have to hold your hands across your chest so that you don't have that potential. What do you all think about those technique points?

DR FRANCIS: There's one that won't work with your guys..If you grab their hair (but they don't have any) that stops the inertial effect of the arms and the neck so the issue here is to support the weight of the head to take out the sternocleidomastoid. So I think you've got to be motionless from the shoulder girdle on up when you do this activity. You increase the resistance by putting the hands up over the head. That's the real key. **The bottom line is that a number of these exercises are hip flexor exercises so your guys are getting stronger and stronger in the hip flexors which exacerbates the lordotic posture and ultimately low back pain. So I think you've got to get hip flexors out as much as you possibly can in any of these pseudo-abdominal exercises.** For example, the straight leg sit-up is a good exercise for rectus femoris. You can palpate it while they're doing it - it's clearly a hip flexor exercise. And a mild static isometric exercise for the abdominals. **You've got to think about the abdominals in a functional range. Over what range do you want the abdominals to be functional? You want it to be as close to the anatomical position for most things you do.**

CAPT BUTLER: So that - with the bent leg - you get more of your abs and less of your rectus femoris.

MR KOCH: The exercise that the guy was doing there with his knees slightly bent - what we see as coming around now, is that weak link in this abdominal exercise. When you put your hands behind your head, I agree that adds weight to the movement and we know you're going to pull. The problem is when you lay flat you do a crunch... that's your abdominals. As you start to come up, that's when you bring into play your lower abdominal muscles because your hip flexors are pulling the other way. That's the compound exercise for the front of the body. It's a great exercise. The problem is you're not eliminating the weak link which is that center point. If you watch him do it, you'll see, just as he comes up there's a catch in the middle where his lower back starts to come off the ground is where your lower abdominals take over from the upper abdominals and you flip into hip flexors. The lower abdominals again remember what the abdominals do - they bend the spine. The pivot point moves down. So at that one point where his center of gravity is now - that exercise right there - not this one but the next one...Because this is the same... see right there you'll see where he's got a little catch right in the middle there - you can see - his hip flexors grab and his lower abdominals take over. That's the weak link. That's why women have problems with lower abdominals - that's why guys have it. Because we're trying to complete the whole motion without correcting that weak link. And that's an important weak link and I feel it's a weak link that leads to a lot of back problems. Because we're trying to perform the movement. We're not trying to create the strength throughout the movement. We can do abdominal crunches till we're blue in the face - but in the real world how much do they actually do anything? It's that lower section right when you have to almost work with the legs with the whole hip flexor motion - it's that weak link in the middle that's never been corrected. That's what you have to think about because you want to have the whole front of the body working together because that's the way it works when you go out. That's why back problems are caused because those lower abdominal muscles - you have somebody doing reverse sit-ups properly and they give out almost instantly. That's a weakness in the lower abdominals. What we try to do is we try to perform repetitions and use our legs to flip up. Even in that you see him - he's trying to do that and you guys are sitting there when he did that he knew exactly what this tape was going to be used for he knew that every eye in the community was going to be on him and he still couldn't perform it correctly. You can see the little hitch that he gets in there when that movement starts to go over. And I mean that's the kind of thing that has to be looked at - why that weak link - and there's a way to work that weak link which we can go into at some other time.

MR GOSS: **And I think it's also important to balance out the hip flexors with hip extension type movements. So lower abs are important, upper abs are important, obliques are important, hip flexors are important, but you're going to also need to some work with the hip extensors.**

DR FRANCIS: There's a loose terminology that you often hear - I have studied anatomy for 25 years and I don't know what the upper and lower abdominals are. There's no such thing. There may be some confusion between the abdominals and the hip flexors. What you are seeing here is a two-phase activity. Initially the abdominals work, and when they contract, the scapula come off the floor. Then he shifts to the hip flexors essentially. There is no

functional entity that I can see in task specific things where your guys bring their nose into their navels. There's nothing that's really a mission of these guys that you do that. The functional range of the abdominals is relatively close to the anatomical position. **When your shoulder blades come off the floor, you've done about all there is to do with the abdominals. The rest of the thing is air time.**

MS STONE: Dr. Francis, couldn't you make a case for doing abdominal work bent knee, but with the lumber spine in some type of lordosis - again getting back to your functional position instead of a flat back?

DR FRANCIS: You bet. You really need to find a neutral spine there to do it properly.

MS STONE: Yes. **What you try to do to exercise your abdominals is start maybe slightly past your lordotic standing position and work slightly past into spinal flexion.**

CDR MOORE: **Can you show us what you're talking about?**

MS STONE: **What you're going to do is take something - a roll of something that won't compress - and place that roll in the small of your back, so that now you have that curve in your spine laying down that's similar to what you have standing up. What you're trying to do basically to strengthen your abs is go from this position to this position because that's how you use your back. So what you want to do is exercise with some curve in your lumbar spine as opposed to flat back.**

CDR MORRIS: **And you just bring your shoulders off the ground?**

MS STONE: **Yes.**

MR KOCH: And you can do a sit-up with that also to come completely up with it.

MR RYAN: If you look at the functionality of the sit-up as far as what its going to do, it's not exactly functional because you put very little from a spine neutral position. You do most of your activity from a spine extended position to a spine flexed position.

CDR MOORE: From extension to neutral is were you get the maximum benefit.

DR FRANCIS: Equidistant beyond that. You want to be equidistant either side of your anatomical position because that's functionally where you operate when you deviate from neutral.

CDR MOORE: But you're saying once you get past spine neutral you're starting to throw in hip flexors.

MR RYAN: Not necessarily. **Is the sit-up, as its done now, functional? No. Because in most activities we function from a spine extended position to a spine flexed position. Now in a sit-up, as depicted here and what everybody generally does, you only move from a spine neutral position to a spine flexed position.**

CDR MOORE: So the sit-ups should go from a spine extension. Once you get past neutral and forward and you hook electrodes to somebody's abdomen, are they still firing?

DR FRANCIS: Yes. They continue to fire, but mechanically, as that movement decreases. As you bring your trunk further over your sacrum there is no load...they are active - they're surprisingly active over quite a range.

DR ALMEIDA: Right. There's also a big difference in effect depending on whether or not somebody holds your feet. If you perform a sit-up, bent knee, without your feet held down, the rectus abdominous fires more than if your feet are held.

CDR MOORE: What's the hitch that Fred's talking about here through that range of motion?

DR FRANCIS: It's just reiterating what was said. The human posture, when you're doing most things, centers around a slight gentle lordotic curve. What your abdominals do is bring you into slight flexion from there in the real world or bring your back from slight hyperextension from there. So if you start and mimic an erect standing position with some kind of lumbar support, in the few degrees up through to a neutral spine beyond is the functional range that you swim you sky dive you walk you run that's the range you need it in.

MR KOCH: What we find is that when you hold your feet and you move your center of gravity, that's why it goes to hip flexors. When you're functioning, you still have to have that weak link where that hitch is. And that's how we do things. I mean we're doing things through that weak link. I really think that has to be considered with the sit-up. And again with the sit-up you want to work the hip flexors because what I've seen in sports is we've lost a whole generation of kids because they don't do sit-ups anymore so they have no hip flexors and they can't run. There's no transition between the abdominal work and your - I mean the muscles have to work together and be balanced together. If you bring one set of muscles up you have to bring the weak link just like what you were talking about with the push-up - the push-ups won't go up until certain muscles are strengthened. Well it's the same with the sit-up - and I think the sit-up is a functional exercise and it's something that I really think if you are not holding the feet down and if it's done properly, and the weak link is worked, it's a good movement.

MAJ LILLEGARD: Mr. Koch, are you saying that people are using momentum in the initial part to get them through that?

MR KOCH: Of course. We all know that. Everybody looks at how many numbers we do, not at what the end goal is. The end goal is to be a functional machine, not how many numbers we can do to get to that end goal. If you did a sit-up correctly like that guy was doing you may find you'll only be able to do 20 or 10 because of that weak link. Isn't that what we want to deal with so that we become a better functional machine overall.

CDR MOORE: I think numbers do get important in PRTs, and especially when you get into that mentality.

LCDR MEYER: Yes. And in a certain amount of time.

BM1 CUMMINGS: I think having done all variations, I pretty much narrowed it down to doing a quarter sit-up with arms crossed. That's a new variation supporting the lower lumber there, but the one that causes the least amount of pain and actually does the most (gives me the most burn) is the knees bent quarter sit-up - coming six or eight inches off the floor with your arms crossed. That will alleviate the leverage back there and alleviate the pulling, and keep the numbers low like 25...and you're doing it slow.

CDR MOORE: I think we're moving in to the question of hip flexors, and I think we'll address that in just a minute.

LCDR MEYER: Yes, we'll have to. Are you saying that they should be worked out separate or together or...?

MR KOCH: You could work them out separate - but what's the end goal? The end goal is to have them work together. So to work the pieces - to work two strong pieces hip flexors and say upper abs in this case and leave the center and lower abs - lower abs spin the pelvis, right?

DR FRANCIS: Well I'm not sure what lower abs are...

MR KOCH: The lower segment to the rectus abdominous.

DR FRANCIS: It goes all the way from the .....it's the full length there.

MR KOCH: Right, but the lower segment. It's segmented because of the...

DR FRANCIS: Any nerve fiber can go to numerous sections of muscle between the tendinous inscriptions, and they're all mixed up. Which means you cannot independently fire separate segments of...

MR KOCH: You see, there's a whole group of people that says that they do have some segmentation, because when you're running a movement...

DR FRANCIS: Segmentation exists, but they are not independently innovated. There's hard research that shows that. Whereas I know outside in the community there are lots of ideas about abdominals. There's more talk about abdominals than any other part of the body with less justification for strong opinion. It's a difficult area to do research. We tried to do some at Children's Hospital but no one wants to volunteer to have needles stuck in the different layers of your abdominal muscles not knowing where we're putting them. They're as thin as paper. And getting a fine wire electrode in there is really tough. So there's a lot of speculation about the abdominals. I'm a little cautious of dogmatic statements other than thinking in a biomechanical sense about things that are proven to create a training effect.

MR KOCH: So we don't have an argument...Let's say the weak link - there's a weak link in the movement of the body and that's what I'm saying is that you have to concentrate. There ought to be something to deal with the weak link of that movement where your hip flexors take over - your abdominals switch into your hip flexors. There's a switch over point there, so that we don't get into lower/upper abdominals.

DR FRANCIS: Yes, I'll buy that.

MR KOCH: There's a switch over point and you'll see it in him where he does that little hitch. If you lay on the floor and try to do one, you'll see that switch over point. That's what I'm saying is of concern. The upper and lower...we can strengthen them. Or the hip flexors and the abdominals... you can strengthen them. But, unless we deal with that weak link...I think that's the most neglected piece that becomes the biggest problem for low back work, for any kind of trunk rotation or pack carrying or hill climbing and that kind of thing.

DR ALMEIDA: What's your concern about that? Is there some evidence that indicates - what you're calling the "weak link" - is associated with some injury?

MR KOCH: We're looking for a balance. The body works in a balancing position. If we want the body to come up in a functional atmosphere - like we're talking about combat here - what we want to do is not strengthen strong points, we want to strengthen weak links. That brings the whole structure to the higher level for injury. I feel that there's a weak link in that movement that is overplayed by the fact that you can do 800 crunches.

CDR MOORE: Let's work it out in the groups, okay? Let's have some interaction between the groups and as a panel, in the interest of time, lets move through the exercises. These are fine points that are important, but we need some time to work on them in the group sessions.

COL ROONEY: Commander Moore, just one point on the sit-ups...I think you might address in the strength group, the eccentric sit-up. When you're using a plyoball or are starting in the crunch position and coming back down where that eliminates that pump to get back up. That's another way to exercise and I think that you will probably address it.

9. CRUNCHES

Discussion Summary:

Keep this exercise, but support the lower back and pay attention to proper technique.

Discussion:

CDR MOORE: Any potential for injury?

PANEL: Low.

CDR MOORE: Keep? Or is there any consensus to modify?

PANEL: Keep.

MR BEETEN: But you ought to be supporting the low back just like you did on the straight sit-up.

DR FRANCIS: How strong are the water bottles that the guys carry? I'm wondering if - could you lay on it?

CDR MORRIS: Hard plastic. They wouldn't set well.

10. HIP ROLLERS

Discussion Summary:

No recommendations were made to eliminate or modify this exercise.

Discussion:

CDR MOORE: Those are hip rollers.

LCDR MEYER: Yes, I haven't seen those done that much.

CDR MOORE: Comments on the hip rollers. Potential for injury?

PANEL: Low, because they're done slow.

CDR MOORE: A consensus to keep those?

PANEL: Yes, as a filler.

CDR MOORE: So these other ones...that perhaps serves the same function?

LCDR MEYER: They aren't done that often.

11. STOMACH PUMP-UPS

Discussion Summary:

This exercise strengthens the hip flexors, not the abdominals. The consensus was that there are a sufficient number of exercises that engage the hip flexors, and therefore, this exercise is redundant.

Discussion:

CDR MOORE: Pump-ups. Comment on those...what area are we working mostly there?

PANEL: Hip flexors.

LCDR MEYER: So, that might be a better way to work the hip flexors than the flutter kicks...when that comes up.

MR RYAN: I don't think that you need to worry about working your hip flexors.

MR BEETEN: You get everything with hip flexors.

LCDR MEYER: So you're saying you might not need any extra exercising?

MAJ LILLEGARD: There are a lot of exercises that include the hip flexors. There's a lot of them that include that, that we're still going to go over.

12. HELEN KELLERS and NUCLEAR SIT-UPS

Discussion Summary:

This exercise strengthens the abdominals, the obliques, and the hip flexors. Proper technique requires that the pelvis remain stable in a neutral position.

Discussion:

LCDR MEYER: Do you want to see the Helen Kellers? They're kind of similar.

MAJ LILLEGARD: They're almost isometric. They give you much more of a burn.

CDR MOORE: Hip flexors also?

PANEL: Yes.

MAJ LILLEGARD: Since that's a paired one, is that really done much?

CDR MORRIS: In the teams I'd say more than in BUD/S.

CDR MOORE: Any comments? Are we getting obliques again?

MS STONE: If it's done properly.

DR FRANCIS: It's a lateral flexion to some extent isn't it?

PANEL: Yes.

MR RYAN: **My only comment would be that you need to stay in a hip neutral position, because if you drop the pelvis back in the hip flexion position than it's a hip flexion exercise - which is a good way to cheat. We see it all the time.**

13. PRONE BACK EXTENSION

Discussion Summary:

A recommendation was made to modify this exercise. It should be done prone, or on the hands and knees, lifting one arm and the opposite leg at the same time and holding this position for 3-5 seconds.

Discussion:

CDR MOORE: Comments? Potential for injury? Low?

MS STONE: If you're trying to do a functional back exercise you don't tend to do a lot that way, you tend to do it in opposites. **So I think a better exercise would be prone lying and lifting opposite arms and legs.**

CDR MORRIS: We call that rocking. When you lay on your belly and you just tense up.

MS STONE: No, you'd lift opposite arms like this.

CDR MOORE: A thought to modify that?

PANEL: Modify.

LCDR MEYER: How long do you hold that? I've seen it done different ways.

MS STONE: I don't think there's a huge consensus. I'll say a count of three to five, but I can't tell you where I got that from.

14. VEE-UPS

Discussion Summary:

It was recommended to modify this exercise by performing it slowly and holding it longer at the peak. It was recommended to keep the legs in a vertical position. One can then touch the toes from a lying position or place the hands behind the head and slowly bring the chest up.

Discussion:

CDR MOORE: Comments? Potential for injury?

DR FRANCIS: It's a pectoral exercise basically.

UNKNOWN: You should hold it longer.

CDR MORRIS: That isn't what gets tired when you do it. It's your stomach - you fail in here.

CDR MOORE: The potential for injury - any feelings on that?

MS STONE: **If you're looking at hip flexors pulling on lumbar spine, then you'd have to put that in the moderate category because that's really what you're doing. You're using your abs isometrically and you're kind of throwing your arms and knees together with your hip flexors.**

CDR MOORE: So, perhaps modify to hold that or slow the count? Watch your cadence?

BM1 CUMMINGS: **One variation of that is just keeping the legs in a vertical position and then reaching up and touching the toes from a lying position. It takes a lot of the hip flexor work out.**

PANEL: Yes.

15. IN BOARD/OUT BOARD

Discussion Summary:

This exercise strengthens the hip flexors, not the abdominals. No modifications were recommended.

Discussion:

CDR MOORE: Potential for injury?

MS STONE: We're still talking hip flexor exercises.

CDR MOORE: Any modifications for this?

PANEL: Keep it.

16. GOOD MORNING DARLINGS/FLUTTER KICKS

Discussion Summary:

These exercises are actually hip flexor exercises and not abdominal exercises; however they are often performed in a misguided attempt to strengthen the abdominals. Both hip flexor and abdominal strength are required for SEALs to function in operational environments. Therefore, it is important to identify which exercises are appropriate for which muscle group and include both in a PT program.

Strong hip flexors and abdominals must be balanced with strong hip and lumbar spine extensors. Over developed hip flexors can contribute significantly to chronic low back pain.

Proper technique when performing these exercises is essential to avoid placing undue stress on the lower back. Proper technique involves keeping one foot on the deck, lifting the head and slightly rolling the shoulders up, and/or placing the fists under the pelvis. Doing large numbers of these makes it difficult to maintain proper technique.

Discussion:

CDR MOORE: Potential for injury? Same as the others?

UNKNOWN: What do you working in that exercise?

PANEL: Abs and quads, hip flexors.

LCDR MEYER: This is one of the controversial ones - that and the flutter kicks.

LT GUINAND: There's that one, the flutter kicks, the Helen Kellers and again we've got a ton of hip flexor exercises. It's the one where you're using your hip flexor but accentuating your lordotic curve that give you the lower back problems.

MS STONE: **I think you need to discuss all of these in a group. Because as everyone's talking about it, there are about 8 or 10 exercises in there that are hip flexor exercises and I think we need to step back and say, "...why are we doing these exercises?" Are we doing these to exercise the hip flexors or are we saying that as we move the legs around, we're exercising the abs? Because if you're saying you're exercising the abs, I'm not sure you're doing that. You're definitely doing an isometric contraction, but most of the stress is on the low back and hip flexors and if that's what you want to do, then I think the exercises have merit. But if you're saying we're doing these to exercise the abs, then I think you need to step back and perhaps not eliminate all the exercises, but look at the quantity that you're doing.**

CDR MOORE: Or consider the order.

LCDR MEYER: And there's an injury potential.

MS STONE: Do you need eight of these different exercises every day, or do you need one and use the eight to vary from day to day for the brain's sake, not for the muscles.

LCDR HOEKSEMA: **There's a general principle though, if part of this conference was chronic low back pain or something. Any exercise where you are supine like that and both legs are off the ground at the same time is not a good thing to do to your lower back. And all of these exercises do that.**

LCDR MEYER: **That is a general recommendation to keep one foot on the deck.**

LCDR HOEKSEMA: **It could be an easy modification.**

MS STONE: **If you want to exercise a hip flexor and reduce the strain on the low back and get some isometric abs at the same time then keeping one foot on the deck would do that.**

CDR MORRIS: Do you reduce the strain on the lower back by putting anything underneath the lower back or buttocks? By sitting on your hands like that or something?

MAJ LILLEGARD: **Yes, you can keep the lumbar spine back in more neutral position with your fists under the lower part of your buttocks. But you still have to force yourself to keep your spine in a neutral position and that's the hard part for the average person.**

LCDR MEYER: **Especially when you're on your 200th one.**

MAJ LILLEGARD: **Right. And you lose form as it goes on, but it can be done correctly, I think, with minimal stress on the posterior elements. I guess what we have to decide is...is it realistic to expect all these trainees to be doing that consistently. It's very easy to lose form.**

LT GUINAND: Like when you're doing Helen Kellers you should actually have the spine flat. Does that actually take less pressure off the low back? It's going to hurt just as bad. Sitting flutter kicks aren't any easier to do than the others.

CAPT CULLISON: **One way to modify this is to lift the head a little bit and sort of roll your shoulders - and get rid of some of the lordosis doing that. And you can throw that into any of them.**

LCDR MEYER: And make it harder.

CDR MOORE: Lift the head off the ground?

CAPT CULLISON: Yes. You can't lift your chin without getting rid of some of the lordosis. Well you can, but it's difficult.

BM1 CUMMINGS: When you're doing a so-called abdominal exercise, and you're using your legs, aren't you adding leverage to potential back injury?

MR BEETEN: **I think it's a lot of what Ms. Stone said. You have to come to decide whether you really want all these hip flexor exercises. Or was it really what we thought initially in all these, that they were great abdominal exercises. I have a feeling that they started out as abdominal exercises, and we found out they weren't. We just kept leading to more of them which ended up not being abdominal exercises. So, maybe what you want to do is go back and say what are abdominal exercises.**

LT GUINAND: Isolate them.

MR BEETEN: Yes.

CDR MOORE: Maybe one of the recommendations from the groups...If you could group these, and give us a good grouping of these in terms of abs and flexors...

MR KOCH: **The point is you want these things for swimming and that kind of thing. So I think what might be talked about in a group is how much is too much. Flutter kicks to me is a great exercise for swimming. You need strength and muscle endurance for your hip flexors in that plain almost. But how much is too much? At what point**

does the lower back become affected? If some kind of a test could be developed to find out where that falls in...

CDR MOORE: **How much are we working on the front part of our body and eliminating the back?**

BM1 CUMMINGS: **We've only seen one exercise so far for the lower back. And it was a partner assisted exercise. My whole statement is that it's very much out of balance as far as abdominal and lumbar.**

MR KOCH: And how much for the abdominals? How overtrained are they? They're not - even though they're supposed to be used all the time. At what point does it become counter productive? If you did arm curls every day, fifty times, you might get to a point where you couldn't pick your arm up because your muscle is so overtrained. I think that has to be looked at.

CDR MOORE: As you break into your groups perhaps each group can kind of comment on that. I think it applies to flexibility, biomechanics and strengthening in terms of the amount or the lack of. Some areas are deficient.

DR KAUFMAN: Commander Moore, what about doing hanging leg raises? It would help with grip strength and wouldn't effect the lower back.

CDR MOORE: Hanging from a bar?

DR KAUFMAN: Yes. And the remedial position would be with the legs flexed and the advanced position would be with the legs extended.

MAJ LILLEGARD: You'd still be arching your back, though, when you're doing the leg raise.

DR FRANCIS: It would be in traction.

MR RYAN: **I still have a problem. I would make a guess to say that all the low back pain that's seen is either created by hypermobile segments at L4-L5, L5-S1...and then S1 joint dysfunctions primarily based upon all this hip flexion work.**

CDR MOORE: Keep those ideas with you when we go to the group and put them down on paper... Let's stop with flutter kicks. That seems to be the contention. We'll agree that the flutter kick is another hip flexor exercise.

LCDR MEYER: It's a contention because they do so many. It's one of the most used.

CDR MOORE: Could you, Commander Morris, comment on the use of - again I don't want to get away from the primary mission we're trying to do in the group - the fatiguing a candidate - breaking down. In your mind, are you using hip flexors to really break these people?

CDR MORRIS: I don't think we're trying to break them. What we're trying to do is put them under. We're trying to give them the exercise so that they can become stronger and at the same time, work them to failure on the exercise and then move on the next exercise. Of those people who don't show the capacity to be able to keep up with what we believe they ought to be able to do, then I suppose you could call that breaking them. There's a better word for it, but the idea is that they're being tested to push beyond what they believe their capacity is mentally. Mentally, they will stop way before they have to. What we're trying to teach them and give them confidence in is that they can perform way more than they think they can. That's why we push through these to failure. Some people perceive that as us trying to drum these people out and we're perceiving it as trying to make them aware that they have a lot more capacity than they think they do. I learned that in training that I could do a lot more than I thought I was capable of, and when you get past the pain threshold and into this other zone you can just keep on going. In the missions we have it is important that we have that kind of individual that will continue to press even though he doesn't physiologically feel like it or emotionally feel like it.

CDR MOORE: Does it take the teeth out of your ability to do that by modifying or using these in different orders or using less hip flexors and more of another type of exercise to fatigue these individuals?

CDR MORRIS: It's a little too early for me to say it does or it doesn't. We could take anything and make it miserable if we wanted. I'm not too concerned about that. What I would suggest is that I try not to contaminate the process here too much and just allow you to come up with what you think is the correct way. And then of course, we're not going to change the name of Good Morning Darlings, and we're not going to do all the other stuff, but we'll change what we think will fit into the program and if we see it jeopardizing something that maybe we won't modify it as much. It sounds to me all of us agree that we thought we were doing a lot more stomach work - and we find out that we're doing a lot of hip flexor work instead. So with that awareness, we may be able to adjust some of these. I don't know what to what yet.

MS STONE: Maybe what we should do in groups is differentiate between what's going on in BUD/S and what the operators need. Because there an exercise may not be the greatest exercise in the world, but it may have a purpose in BUD/S whereas once somebody gets through that it loses its purpose for the operators.

LCDR MEYER: I think they develop their habits at BUD/S and then take them to the teams.

CDR MORRIS: We want to train smarter. That's a comment that we always use, and we've always wanted to do that, but we still want to keep that element of going beyond. It means all of these are great exercises done to fatigue - done to failure - are going to put them in an injury prone position, maybe that's where the injuries are coming from. One of the changes might be that they're only in that for a short time but once we've seen that they've gone to failure and that they continue to try to push through that, then we say okay, move to the next exercise. If we knew that we were moving instead of from stomach work to hip flexors, then we wouldn't go from hip flexor to hip flexor. Right now we'll change from flutter kicks to sit-ups and we'll think we changed but we really didn't.

UNKNOWN: Before we totally condemn hip flexors - aren't most of your swims done with fins?

CDR MORRIS: He's absolutely right. I haven't pointed that out, but..

UNKNOWN: There's an operational reason for doing a lot of hip flexor exercises, because you don't do that every day. One way of maintaining hip flexor strength is to do exercises that apply to what they have to do in prolonged distance swimming with fins...where you don't use your arms.

CDR MORRIS: What I've been told all of my professional life is that the most effective way (and it seemed to prove true for me) is to keep your knees straight with your fins on and actually swim from here...from the hips and do that. Plus you've got to do other strokes up here where you're moving, and that seems to be more effective than if I'm kind of bicycling or kind of pedaling in the water with my fins on. You don't get the same force out of your fins. That's what we teach, that's what they do, and they seem to be (like I mentioned yesterday) very successful at doing the water work in comparison to the other armed forces.

COL ROONEY: **It's been mentioned several times that one of the main problems is muscle balance. I think you can keep hip flexors as long as you add in some more hip extensor work on these people. I think that's where you run into the overuse problems, you run into the muscle balance problems.**

MR RYAN: **And more detailed flexibility work with the hip flexors.**

CDR MORRIS: **That would be good if you had a recommendation that showed...here's your hip flexor stuff and you need to do that and of course you can do it as long as you want...in the teams maybe not as long as BUD/S, but here's your extensor and they balance each other.** Then the instructors, armed with that kind of information can go out and balance these students through the course, and still make them think that they need to quit and don't.

DR FRANCIS: Operationally, it's endurance of the hip flexors and hip extensors...that's the key issue. You shift from a training regimen where you're working on strengthening those

two muscles to get to a certain level of strength, then you change your biomechanics. There's that kind of passive knee bend where you get good biomechanical efficiency using good fins. So, although you train deliberately to do something about those muscles in flexion and extension in the hip by extending the knee, on an endurance mission, you don't do that. You switch to an energy conservative mode and then the key there is just endurance. I think your point is well taken...that you need a certain strength level. But the limiting factor in a mission would not be strength - it would be endurance for sure.

CDR MORRIS: It was interesting to listen to you talk about strength. I thought that if I did 100 push-ups then I was stronger than if I did 50 push-ups... and all I am is more able to endure. So I would have to say that I guess my experience in a lot of the things we do are endurance related until you throw a 55 horse outboard on your shoulder and carry it through soft sand at the beach. Or if you're at sea and you've just launched a Zodiac and you're standing there bobbing along in the water, you have to take the motor out of the well of the Zodiac and place it on the transit, and there's on place for your one foot to go except into the ocean and the other foot so you're kind of bent into a position, that becomes a strength exercise that needs to be trained for.

MS STONE: Yes. Basically, you're trying to train them in various ways in "safe positions," but you get out there and you don't have a choice as to what position you're in. Whatever it is you have to work there. Which may not be the "safest" most biomechanically efficient.

DR FRANCIS: Just one last word on swimming with fins is that the place where people break down is tightness of the gastroc soleus. You're going to get cramping. That need for extensive plantar flexion when you swim. So that's where the stretching initially comes in that will lessen the mechanical stress. The other place you're going to get it is in the intrinsics of the feet. Some candidates will cramp up in fins. So it's not often that the hip flexion and extension are limiting factors in performance. So as far as these stretching issues and targeting things, such as the feet, where you really do get failure on missions.

CDR MORRIS: Yes, it's true. All people you put in fins and throw them in the ocean - they start cramping up in their feet. That's exactly what happens if I don't swim regularly with my fins and I stick them on then after a little while...I start cramping in the feet. It isn't too many swims after that where you don't get that anymore. The exercise that we do, although you don't see it in the TV group, you see it in the ocean or the bay when they put the fins on and swim, they fin swim regularly which develops that capacity. Then they don't get those during swims. And then, of course, in BUD/S they're doing the 5 mile swim - again that's to teach them that they can push beyond what they think they can. Most people don't believe they can swim five miles.

CDR MOORE: Fantastic. Captain Butler, one last comment?

CAPT BUTLER: As we're going down this list of things here we're sort of taking each of these exercises and dissecting them intimately as a single exercise. I wonder if it would be

worthwhile for each of your groups to put together their best recommendations for a 30 minute program where let's say you have 30 minutes and you understand that you're going to go do something like a swim or a run after the PT is over, but to take this 30 minutes and utilize it as best you can with a combination of these different flexibility exercises and strength building exercises. So that we don't just give them 80 exercises with sort of what we think about each exercise, but we say you got 30 minutes to spend, it's going to be a combination of strength and flexibility training, and here's how we recommend that you spend it. In fact going one step further, we really have two types of PT: One is where you have a PT which precedes an endurance event like a run or a swim, and then when you're deployed often times you'll have more of a long PT where you'll have 60 minutes or longer and you can do different exercises and more reps of the same exercises. So you're really looking at a 20-30 minute short combination PT and then a 60 minute or so expanded one. It would be good to have some suggestions from the different groups as to what the right mix would be.

CDR MOORE: If your groups get tight, you could give a sort of chinese menu of the exercises that you saw and, as time permits, to give us what you think are the best out of that menu.

CAPT BUTLER: And include order. Obviously you wouldn't be doing the static stretching first. But what order would you do them in?

CDR MOORE: We appreciate the efforts. Let's break and muster up in your groups.

IV. FLEXIBILITY AND REHABILITATION WORK-GROUP FINDINGS

Work-Group Members:

Jennifer Stone, ATC
Bob Beeten, PT, ATC
Ed Ryan, ATC
Lisa Meyer, LCDR, MC, USNR
Dick Guinand, LT, MC, USN
Lee Sandstede, HM2, USN

A. REPORT OUT

MS STONE: We took the liberty of creating a few exercises. And I won't necessarily bore you or insult your intelligence by reading what we've written - I'll just mention a couple of highlights.

We did a couple of things. We took a look at the medical program from the injury prevention and care point of view, and recommend that it be more proactive - especially with the operators. There needs to be some proactive stuff done with BUD/S, but the point of that program is a little different than what goes on with the operators. We freely admit that we are civilians looking at something that we think we understand and trying to equate it with an athletic program. **The most important thing for an athletic medical program is to make the programs readily available, convenient, user friendly, and have little stigma attached to presenting yourself for proper medical care. If you do that, then what you're doing is getting to people early and hopefully taking care of a problem in two or three days where if it's let go, it could become a two or three week or two or three month problem.** We tell our people routinely, we'd rather see you and tell you it's nothing, then not see you until it is something. We try to change the mentality so that the athlete feels he is not making a complaint, but voicing a concern. Maybe that's splitting hairs, but I think that's the attitude that could benefit the operational community.

From the proactive point of view, how do we start to prevent injuries recognizing the fact that you can't prevent everything that happens. The biggest recommendations that we would make are the same ones we make with our athletes. You need to have adequate warm up, and stretching is not necessarily a warm up. Stretching may be part of a warm up, but it's not the warm up. You also need a warm down so what you're doing is getting ready for exercise and then returning the body back to normal. The more intense your activity, the longer your warm up. If you're going on a 5 mile run, there might not be the necessity for a formal warm up because the first part of your run is the warm up. You start out a little bit more slowly and pick up the pace as you go. We would suggest that after every PT session, run, and swim, that there is a 10-15 minute period of time for static stretching so people can cool down, work on some problem areas of flexibility. Certainly the BUD/S people that we saw, all of them have tight hamstrings. If you look at injury prevention, then somebody with tight hamstrings is also predisposed to patellofemoral problems. If you attack the hamstrings, you may not solve your patellofemoral problems, but you're getting a leg up (pardon the pun) on the problem.

We then made some suggestions about what needs to be included in a rehab clinic. Probably more to the point, you need a place, but you also need a person - and a person that's a constant. Your corpsmen and your medical officers rotate through, not unlike the Olympic committee's volunteer program, but what we have is a core group of staff people that are the constants. When operators come in, they know this one person and they can say, yeah, Dr. Smith is okay and you can trust him. You don't have to go

through the 6 month or 12 month feeling out program with all the new people that come in.

As far as the PT program - we went through and tried to take a look at the exercises that the whole panel agreed were reasonable exercises and group them into different body part areas to develop a menu to go through so that if you're doing a 30 minute work out, you could select 1-3 exercises from each group. If you're doing a longer work out of 60 minutes, select 3-6 exercises from each group. This gives people the flexibility of doing different things at different times... for boredom's sake, for different exercises sake, for different sides of the body's sake. I won't go over some of the exercises that were already on the film, but we did add shoulder, arms, and chest. We had talked yesterday about doing push-ups with a plus - push-ups with a little more extension in the shoulder, finger tip push-ups, and fist push-ups again for variations and some forearm exercises.

When we started to look at the exercises, we had a whole lot of pushing exercises with the arms, but we didn't have any pulling exercises with the arms. So we suggested what we called the incline pull-up and thought that could be done on the dip bars over in the BUD/S area. Basically, we thought about using partners to do this but we decided that probably wasn't the greatest idea, but if Ed is dressed up as a dip bar...you can lay down on the ground and basically you would do a pull-up and back down again - with better form than I just did. So that you would pull yourself up toward the bar to a 45° position and lower yourself down. You could also emphasize pushing or pulling together shoulder blades in the back. There really weren't any upper back exercises in that pulling type position.

Under back exercises, we came up with a couple new ones. We called one of them the "Superman exercise" and that was the one we talked about for developing balanced strength in the hip and back extensors. You use opposite arms and legs in a prone position as well as a kneeling position.

CDR MOORE: Could you demonstrate those?

MS STONE: Sure. The prone Superman was just laying on the ground with your arms out and your legs out and lifting opposite arms and legs, holding them for the count of 3-5. Kneeling, use opposite arms and legs again where you're just extending out and back down.

MR BEETEN: You're going to love this one - it burns.

MS STONE: That's your hip extensor. And we actually have a variation of that later on for more extensors.

DR ALMEIDA: Is the back held flat?

MS STONE: Yes, the position is with the back flat, but not sagging.

CDR MORRIS: We do a kind of a thing where you go into a rocking chair position, and then we flutter our arms and our legs. You're kind of doing it with your legs going the same time and you're kind of in an arch. But that's not as good as this one.

MS STONE: That's more stressful on your lower back because you're starting in this position. This exercise is a little more natural way of using your back because you're usually using opposite arms and legs without your back extended.

CDR MORRIS: And you're isolating your extensors.

MS STONE: Yes, so you're working this part of your back as well as your hip extensors.

CDR MORRIS: That will take care of all these lower back problems.

CDR MOORE: Can you make that exercise hurt? Can you make it burn?

MS STONE: Sure. You can do that one for a long time. And if you really want to make it hurt give them something to hold in their hands or attach some weights to their legs.

CDR MORRIS: I'm sure the instructors will find some way.

MR BEETEN: Give them a water bottle that's heavy.

MS STONE: Yes, have them hold their canteens in their hands. Under abdominals, we just took the exercises that were presented on the tape and also made the recommendations we talked about yesterday that to make the back position a little more like the upright position - like to lay down on a rolled up towel to give yourself some exercise from this position to this position rather than from here up.

Under hips - we marked the hip flexor exercises as far as 1) just to identify them and 2) to suggest that their use be limited to no more than a hundred reps per day recognizing the fact that those muscles needed to be exercised but that they didn't need to be beaten to death at the same time.

If you go down the list, Donkey Kicks - are kind of half of your Superman exercise so you're in the kneeling position and just extending the leg out and back - again keeping straight this way exercising your hip extensors.

BMCS NEHL: What about bending your knee and bringing it out to the side the same way?

MS STONE: You could do that in combination with the Dirty Dog exercise. If you want to combine the two - you could sit there and go out and back and down and back.

We created the Burt Reynolds exercise and decided that we were dating ourselves - remembering Burt Reynolds and his centerfold in *Cosmopolitan* magazine. This exercises the muscles on the inside of your thigh. So you're laying down on your side and crossing your opposite leg. All you're doing is lifting your leg up off the ground.

BMCS NEHL: I don't even think I could do that.

MS STONE: SEALs can do anything can't they?

DR FRANCIS: That could burn as well.

MS STONE: Yes, because the Dirty Dog exercises the muscles on the outside and there was nothing in there that exercises the muscles on the inside. So we added that one.

DR FRANCIS: The thing to watch there is that people will do it with hip flexion unless you line them up properly.

MS STONE: Right. That position is very important. This needs to be straight laying on the floor and the reason that you put the foot over the top is that the foot's behind and you tend to roll the hips back. So if the foot is over this way, it's real difficult, but your hips need to be right over the top of each other and lift straight up because if you roll back then you get the dreaded hip flexors in there again.

BM1 CUMMINGS: How about if you put you whole side on the ground? Don't lean up on your elbow.

MS STONE: You could do that. You could lay this way or however you're comfortable. What you do here doesn't matter, as long as this is straight.

BMCS NEHL: Are we supposed to feel this on the inner thigh?

MS STONE: Yes. On your inner thigh.

DR FRANCIS: That's functional for rock climbing.

MS STONE: **All the leg exercises we incorporated are the ones that were on the video tape. The lunges - made a suggestion to limit those repetitions, but didn't put a number on it just an awareness that these are real stressful on your knees.**

BMCS NEHL: How far down should we be going on our lunges?

MS STONE: **About 90°. Like this. And a couple of important technique points are to keep the knee right over the toe so you're not in or out, and...**

MR RYAN: **And the repetitions are probably limiting due to the propensity for poor technique as opposed to sheer repetitions.**

CDR MORRIS: **So you wait until they start to not get good technique and then you switch to the side jump.**

MS STONE: Yes. I think most of the BUD/S people, if I remember correctly, were doing that kind of an explosive type manner coming back and forth this way, and that would be the least preferable way to do that exercise. If you're going to do them, some of those would be fine, but you would need to do fewer of those than just the stride.

BMCS NEHL: That would be something to do after you're warmed up and have been exercising for a while?

MS STONE: Yes.

DR FRANCIS: **The knee cap shouldn't get in front of the big toe. When it does that indicates that you are going over 90°.**

MS STONE: **And the other thing when you're doing your step, you would need to make sure that your step is straight forward and not out to one side or the other.**

LT SCHNESE: Not so much with the BUD/S students but just for a guy - what about with weights? I see a lot of guys doing a bar bell and fairly heavy weights. Is there a limit?

MS STONE: **No I think, again, technique is your limiting factor. When your technique starts to go. You want to exercise to failure, but what's failure? When you can't do it any more or when your technique falls apart? It really is when your technique starts to fall apart.**

MAJ LILLEGARD: Ms. Stone, we were discussing that one in the biomechanics group and we felt that in an effort to prevent patellar pain syndrome and activate the VMO (vastus medialis obliques) preferably maybe a little external rotation of the foot - same technique, but slightly avert that foot.

MS STONE: But I think, as we talked about before, a lot of these exercises are okay or good exercises unless you're not strong enough or unless you're tired and your technique falls apart. It's apparently not the exercise that's bad - it's what happens when you start fatiguing that's bad. There's nothing wrong with doing an exercise to fatigue, doing something else, and then coming back to that exercise. But you just have to make sure the technique is correct.

DR ALMEIDA: We all agree that fatigue will lead to a breakdown in technique and an increased potential for injury. There will be a variation in the initial levels of fitness among

the trainees. Therefore, some trainees will fatigue before others. Guidelines for terminating an exercise should reflect that.

MS STONE: What they did the day we were over there was when people started fatiguing - falling behind, whatever you want to call that, they were pulled back to another group, did a different exercise, and then came back up. It's kind of a group exercise, but with some individualism in it in that you're sent to another group when your technique falls apart.

DR ALMEIDA: That's an important observation. That's something that is being done correctly.

CDR MORRIS: We've recognized for some time that when they get to a point of failure, and since we've all been through it before, you know that they're not going to be able to do it any better no matter how much you yell at them. So we try to find something that would motivate them and that might be to be picked out of a crowd as not being able to do what the crowd was doing. So peer pressure is one. Another one is send them out to the surf zone to get wet and sandy and come back- what that does is change what they're doing, give them a little bit of time to rest that muscle group and come back, and the other thing was the IBS right up front where we could have them dip through that, it cools them down, changes what they're doing, then put them in the back of the group. Those techniques are what the instructors use as a tool to try to do that. And you'll still get the failure. Eventually they'll say get back into the class because the class has changed to a different kind of exercise and then they get back in.

MS STONE: Yes, the instructors seem to be really on top of that part - sending people back and forth and in and out doing different things.

CDR MORRIS: And they do that on the runs too. What they do in goon squads with people who can't quite keep up they'll cut them and then they'll say these people get a particular kind of harassment that changes the nature of what they're doing. They might do wind sprints with them and things like that - speed work. They may perceive it as "I didn't make the squad today. And tomorrow, I'm not going to get in the goon squad." And they're going to put out a little more. Hopefully what we're doing with them will help build them up so that the can do that. Then of course there are those folks who are not trying.

DR KAUFMAN: **The other general idea is that when people start getting tired, if you slow the count down they have more time - instead of getting tired and just jerking, they have more time to do something technically correct so that whenever you get towards the end, you slow your count down. It burns just as much or maybe more, and they have time to stay with the group and have good technique.**

CDR MORRIS: And the instructors do that. They change the cadence, and of course, everybody's eyes are supposed to be on the instructor. It's a follow me kind of a thing, and they will come down 1, down 2, etc., and of course, the instructors stop and everybody else is

still going up and down and they realize and they all get back in the repetition. He's messing with them and burning them and giving them more endurance.

MS STONE: With some of the exercises, there may be merit to just doing that particular exercise more slowly so that you can do more repetitions as opposed to quickly or again- that's a variation from day to day. You may do it quickly one day and slowly the next. When we were looking at the exercises obviously we wanted to fill deficiencies that we saw but not tamper with things that are working and not take away the flexibility and creativity that the instructors need in order to get their program done. Then we put together a static stretching program for them to use post PT, post run, post swim, and made the suggestion that post PT and post run, your stretch is to emphasize legs and post swim the emphasis is on the shoulders and upper extremity a little bit more. Also we made the suggestion that a stretching program doesn't need to last 30 minutes or an hour or 45 minutes or whatever, but that you can get a really good stretching program done in approximately 10 minutes. Questions?

CDR MORRIS: You said you marked the hip flexors - are those the ones with the asterisks on them?

MS STONE: Yes.

CDR MORRIS: Okay.

MS STONE: **One thing I didn't mention is on the front page. One of the things athletes are doing to cool down once they're totally finished with their exercise program is standing in cold water for 5 to 10 minutes. Since in this particular situation you have the ocean out there, there's nothing wrong with walking out into the ocean and standing out there for another 5-10 minutes just letting your legs cool down.**

CDR MORRIS: Could you say that a little bit louder so that the Deputy can hear that please?

MS STONE: Questions, comments?

CDR MOORE: Good job! Thank you!

CDR MORRIS: That really helps.

LT GUINAND: Let me ask you a few things here. At the bottom of page 3 for neck stretches - I think the printer left them out - there should be a third one under there for neck isometrics which is basically taking your hand and pushing your head into your hand going in all four directions front, back, side, and side.

MS STONE: That's on the exercise list. But we had talked about doing a little bit of - for lack of a better term - forced stretching, and I don't know if we ended up putting that in or not.

LT GUINAND: **The third thing was to emphasize that cold muscles don't stretch - that's why the recommendation is to do the stretching exercises at the end of whatever workout you've done. That way you get a more effective stretch and it decreases your chance of injury.**

CDR MORRIS: That's the direct opposite of what we've been doing. We've been doing - prior to each PT we do a static stretch warm up with side benders - and kind of get warmed up - then we go into the heavy muscle exercises and you're saying that we need to warm up with maybe jumping jacks or some type of warming up, but not stretching. You do the stretching at the end.

MR RYAN: **That's correct. I think that there's a distinct difference between warm up activities and stretching activities. It certainly is a good idea to stretch in some way, shape or form dependant upon the intensity of the activity that you're going to perform; however, your flexibility gains, etc., will be made post exercise. Our group used the analogy of a sprinter who is going to perform for maybe 10 seconds, will maximally spend an hour to two hours warming up and stretching. A distance runner will go and start his run and stretch afterwards. So it depends upon the intensity of the activity that you're going to do.**

MS STONE: **So if you're going to run say the 'O' course for time. You may want to allow people 15-30 minutes to warm up and stretch and do some things. If you're doing a regular PT session, do some activity to get people sweating and then go into your heavier activity - maybe without stretching at all.**

B. FLEXIBILITY WORK-GROUP GENERAL RECOMMENDATIONS

1. STRETCHING RECOMMENDATIONS

Stretching is an important element of any physical training program. Proper use of stretching improves flexibility, reduces muscle fatigue and soreness, reduces the potential for injury, and improves performance.

STRETCHING is not the same as a WARM-UP. There is a distinct difference between warm-up and stretching activities. Warm-up occurs with low intensity exercise (i.e., slow jog, swim, bike, or Jumping Jacks). Muscles are most flexible and less susceptible to injury when they are warm; therefore, a warm-up should always precede stretching and exercise. Warm-up slow to fast or less stressful to more stressful.

If the exercise activity is going to be intense (e.g., "O" course, sprinting, weight conditioning, "burn-out PT") it is a good idea to stretch (dynamically) prior to exercise, but after the warm-up. For example, a distance runner may warm up with a slow run, and static stretch after exercise. Preparation for the 'O' course would include 15-30 minutes' warm-up and maybe followed by dynamic stretching. Preparation for a regular PT session should include a warm-up, which may be followed by dynamic stretching for those muscle groups that are going to be exercised during PT. If time is limited, however, it is acceptable to stretch after the PT session when muscles are the warmest. Table 1 represents the ideal recommended stretching sequence.

Table 1. Recommended stretching sequence.

Warm-up -> Stretch (dynamic) -> PT session -> Stretch (static)

Since most of the benefits from stretching occur postexercise, a 10-15 minute stretching program should follow every PT session and every run. Stretches should be slow and static, held for 10-15 seconds, and taken to the point of tightness, not pain. Static stretching provides a good cool-down after a workout and improves flexibility. Static stretching also reduces post-workout muscle fatigue and soreness and is useful for relieving muscle spasms that occur as a result of exercise or rehabilitation following an injury.

2. PANEL'S RECOMMENDED STRETCHING PROGRAM

I. Dynamic stretches may be performed prior to exercise for those areas of the body which are to be exercised during PT. Suggested dynamic exercises include:

1. Neck Rolls
2. Up Back & Over
3. Press-Press Fling
4. Hi Jack Hi Jill
5. Trunk Twisters
6. Trunk Rotations
7. Deep Knee Bends
8. Four-Way Lunges
9. Four-Way Leg Swings

II. Static stretches should be performed following PT. A recommended postexercise stretching program is outlined below.

A. Select 2-4 stretches from each anatomical location listed below, balancing front and back.
B. Select more stretches for those body areas exercised (e.g., shoulders after swim, legs after run).
C. 2-5 reps per stretch, hold 10-15 seconds, then relax for 10-15 seconds.
D. Stretching session should last at least 10-15 minutes.
E. Stretching can be followed by a 5-10 minute cool-down standing waist deep in cold water (e.g., bay, ocean).

1. <u>Neck</u>

a) Ear to shoulders - *pull gently with hand on same side*
b) Chin to chest - *pull gently with hands behind head*

2. <u>Shoulders, Arms, Chest</u>

a) Triceps Stretch
b) Arm across chest
c) Chest Stretch

3. <u>Back</u>

a) Prone (lying on stomach) Torso Stretch
b) Supine (lying on back) single knee to chest and double knee to chest

4. Hips

a) Standing Lunge With Pelvic Tilt (Iliopsoas Stretch)
b) Kneeling Lunge With Pelvic Tilt (Iliopsoas Stretch)
c) Groin Stretch (side to side)
d) Butterflies

5. Legs

a) Seated ITB Stretch
b) Standing Quads
c) Hurdler's Stretch, leg in front
d) Back Benders (hamstrings)
e) Gastrocnemius Stretch
f) Soleus Stretch
g) Hip Flexor
h) Sitting Hamstring Stretch
i) Standing Toe Pointers (for tibialis anterior)

3. PANEL RECOMMENDATIONS FOR A REHABILITATION PROGRAM

The most important elements in an athletic medical program involve making the program readily available, convenient, user friendly, and with little stigma attached to presenting for proper medical care. If these things are accomplished, treatment can be provided early enough to alleviate an injury in 2 or 3 days. If the same injury is left untreated, it could become a 2 to 3 week or 2 to 3 month problem.

The work-group recommendations for rehabilitation included a rehabilitation clinic providing accessible treatment facilities and consistently available medical care personnel. Presently, corpsmen and medical officers complete one tour at NSW Medical Departments, during which the medical personnel are often deployed to support training missions. This is similar to the Olympic committee's volunteer program; however, there is one major difference and that is the Olympic rehabilitative programs have a constant core group of staff people. Such a core group is essential for establishing rapport and trust between operators and medical personnel.

I. Recommendations Regarding Rehabilitation

A. Minimum Requirements

1. Adequate SPACE for an autonomous health care facility.

2. Appoint at least one person whose responsibility is the clinic and who will consistently be in the clinic to direct care.

3. Adequate numbers/amounts of:
   a. Treatment tables
   b. Ice
   c. Compression wraps
   d. Ultrasound machines
   e. Electric muscle stimulation devices
   f. Hot packs
   g. Iontophoresis
   h. Rehab equipment:
      (1) BAPs boards
      (2) Stationary bikes
      (3) Swiss balls
      (4) Slide boards
      (5) Free weights (1-10 lbs)
      (6) Theraband
      (7) Variety of boxes, tilt boards
      (8) Mini trampoline
      (9) Full-length mirrors

V. STRENGTH WORK-GROUP FINDINGS

Work-group members:

Gary Gluck, LT, MC, USN
Walter Andzel, Ph.D.
Fred Koch
Tom Cullison, CAPT, MC, USN
Jim Rooney, COL, USAF, Ph.D., PT, ATC
Kim Goss

A. REPORT OUT

CDR MOORE: Our next presenter is Lieutenant Gluck for the strength group.

LT GLUCK: Strength conditioning throughout Special Warfare, prior to BUD/S and during BUD/S, really doesn't occur. We have recommended incorporating strength training prior to coming to BUD/S, but we don't make significant changes to BUD/S itself. Then we follow with recommendations for the operational SEALs and how they can incorporate strength training after BUD/S.

The first thing we recommend is a mail-out that goes to potential BUD/S candidates so that they can prepare themselves for BUD/S before they come. We would like to incorporate a variety of weight training techniques. A 10 to 20 week cycle should be utilized that uses the periodization technique to increase strength. This can be coordinated with a running and swimming program. Presently we give BUD/S candidates a running program that was designed to rehabilitate people for stress fractures. This includes a third "down" week, allowing their bodies to heal and remodel prior to development of stress fractures.

For the weight training we recommend two sessions, and if possible, three sessions per week. We looked at two different scenarios: People who have weight equipment available to them, and those who don't. Weight training can be started in conjunction with the running program, and we looked at all the different muscle groups that we wanted to strengthen. You can see the list there, working with the calf muscles and balancing those out with the anterior calf muscles and balancing those out with the anterior calf muscles (tibialis anterior) to try to alleviate the stress fractures and shin splints that we see so often at BUD/S.

CDR MORRIS: Would you tell the operators what part of the leg you are talking about there?

LT GLUCK: Okay. We are just starting with the calf muscles and doing calf raisers, as well as toe raisers. That could be done by standing on a block with your toes over the edge and then pointing your toes to the ceiling, or standing on the other end of a block and then doing calf raisers. If you do that with just one foot, it increases the work involved in performing that exercise. If you want to add additional weight, you can do that by carrying any piece of gear, putting weight belt on, etc. The parallel squats with progressive weights involves coming down with thighs parallel to the ground, and then raising back up. That exercises the hip flexors and extensors. Maybe we can have that demonstration.

MR KOCH: Let Mr. Goss demonstrate that - the one legged squat.

MR GOSS: You don't want to have your feet that narrow or you're going to get a lot of shearing forces on the knee, so it would be more with your feet about shoulder width apart, toes slightly out, and then going at least parallel to the ground. If you go any higher than that, you are not going to get the hamstrings or hip extensors involved. We were talking

about the one legged squat...if you don't have any equipment, and you want to make something tougher, you can do a simple one legged squat.

BMCS NEHL: Squats with weights...I've seen guys doing them flat footed, or I've seen guys doing them with a piece of board an inch to an inch and a half.

MR GOSS: You can do that initially if you don't have the ankle flexibility to do that. The problem is that it starts chipping the knee out in front of the toe, and causing some shearing forces.

BMCS NEHL: Okay, so you eventually want to work it where you are doing the squats flat footed.

MR GOSS: Yes. It will only take usually about two weeks or so. We have the problem with basketball players who wear those high top shoes all the time. They tend to be very inflexible in the ankle, so it may take them a month or a little bit longer, but if they do incorporate some of those calf stretches they will develop the flexibility.

BMCS NEHL: But, on the squats, you are only going down so the thigh is parallel to the deck, right? You are not going past parallel.

MAJ LILLEGARD: That's what the group is recommending - to at least parallel. Obviously that is a great strength exercise for the quads, but it puts your patellofemoral joint reaction force at its highest. It also puts about 100% of the weight bearing load right on the posterior horn of the meniscus. So if there is any jerk, or anything like that, that really predisposes you to meniscal tears, which is much more significant, obviously, than patellofemoral problems. But, if we are looking at a relatively high incidence of patellofemoral problems already, I think that would possibly increase the risk of that.

LT GLUCK: That was discussed in the group, as CAPT Cullison mentioned, and that is our experience at the Center. We thought we would put it up for discussion for your reaction. Are there other recommendations for those same muscle groups?

MAJ LILLEGARD: Not as good as far as strength, obviously, so we have to weigh the risk/benefits on that.

MR GOSS: The strength coaches association does have a physician paper out on the squat.

MAJ LILLEGARD: Is it on the same position you showed us?

COL ROONEY: I think if you go below parallel is when you really put the posterior horn of the meniscus at risk. I think you're not in a real danger zone or as dangerous an area when you are at parallel. I think when you go below parallel...

MAJ LILLEGARD: At parallel, your knee angle is about 130°...

UNKNOWN: They used to drop the butt way below parallel, and that is my understanding of where they ran into most of the meniscal problems.

MS STONE: But, I think that the problem with the squat is the same with some of the calisthenics when you start talking about control. We can tell you from personal experience...we've had weight lifters forever...and we've never had anyone tear cartilage or meniscus in their knee unless they twist it. And they do full squats all the time, but they have enough strength to control when they go down. They don't go down, bounce, and come back up again.

DR FRANCIS: You have to be aware of the stresses involved. I have seen a movie of somebody actually snapping their quadriceps tendon. It just snapped under the load. The pressure behind the kneecap when you exceed 90° is as high as 5 times your body weight...pushing the back of the patella into the femoral group. So, I think the bottom line is repetition.

MS STONE: Yes, but my point was that, again, control is the key here.

MR KOCH: People have been squatting for 100's of years. We go into this, and try to nitpick it. You are going to be in kneeling positions in any kind of things that you do out in the field, and this is the one best exercise for it. The human body is meant to go down there. If you do a proper progression, it works. It's been successful in industries and sports. You can't go to one sports team in this country who wouldn't stand 100% behind the squat. We are just talking about 4 or 5 sets for guys, and it's been done for years.

DR FRANCIS: 100%, I agree. What I am getting at is that I don't think that's a good psychological stressor. There is that cost/benefit ratio...

MR KOCH: We are talking pre-BUD/S...for preparing for what they are going to get. Remember, weight lifting hardens and thickens the bones. This whole program is set up for pre-BUD/S, to prepare them for any kind of problems that could crop up from overuse. That is the reason we set this thing up the way we did with the exercises. A short period of time, simple exercises so no one would get really fanatical with it. From what we've seen with this whole program...the strength training part is a simple answer to this bone problem, to this whole stability problem with the knees and the ankles.

MAJ LILLEGARD: So, you are saying to include that solely in pre-BUD/S....

MR KOCH: We suggested pre-BUD/S and post-BUD/S, because during the training there is no time for it. It's a nightmare when you get a lot of people.

MAJ LILLEGARD: So, if we throw in the caveats, any knee pain with this activity, back off for a while...

MR KOCH: In the recommendations we have, if you have any knee problems, of course you don't do it. You don't want these people in the program anyway.

DR ANDZEL: What we suggested was to send out to people who are accepted into the SEALs training (in pre-BUD/S)...to receive a written workout. In that workout you would have correct procedure, warning signs, suggestions if certain things occurred, and so forth. Then in post-BUD/S...

MAJ LILLEGARD: It's real important in post-BUD/S to get that power in the quads.

DR ANDZEL: The exercises we are suggesting are basically just a core of exercises that once a person finishes BUD/S, this is a core of exercises that you still have from pre-BUD/S, you know how to do them already, and then if there are other things you would like to work on, then you can build off of that pre-BUD/S program, and then progress from there.

CDR MOORE: ....from stopping at 60 versus going down through the whole range...

MR GOSS: Well, you're working the muscles through a fuller range of motion, thereby strengthening the connective tissues, and working the hamstrings more.

MR KOCH: We want an exercise, one exercise, that will work as much of the leg's range of motion that you are going to use as possible.

CDR MORRIS: We used to do these on one leg as a common thing in the PT circles in the teams. But, I remember at one point being told that they were bad for the knees, and so we actually stopped. I think probably what was misinterpreted was that we were probably breaking the parallel.

MR KOCH: The progression is so important in this, and that's one of the recommendations that we are getting into... the progression that goes along with this. You just can't go in and do weight lifting depending on whatever mood you are in everyday. Now, the biggest nightmare we have in sports is that the weight lifting program tires out the legs so you can't run. A lot of professional athletes will take a fine for not doing their strength workouts the day before a big practice. Their legs would be too tired from a go to failure attitude from the strength coach during the leg workouts. Thus the legs are too tired to practice correctly. So the progression becomes key, so that your legs are never tired -they just get stronger all the time. That's one of the recommendations.

LT GLUCK: This can be laid out in a very detailed day by day plan including how many repetitions are recommended for each of the exercises. This document hasn't been specifically produced for the SEALs at this time, but a very similar document has already

been produced by the Air Force Academy, and you should have a copy of this physical conditioning mail-out in front of you. We propose using this guideline for producing the same type of document for SEALs. It offers week to week, day to day recommendations with specific repetitions. It's very controlled. It starts slowly, then gives you breaks for your body to adapt, repair, and to strengthen.

DR ALMEIDA: Please correct me if I am wrong...My understanding is that this information is based on laboratory experiments in which animal bones, muscles, and tendons were stressed under different loads. Has anyone ever studied these different resistance exercise programs and measured injury as an outcome?

MR GOSS: Yes, Dr. Herrick (?) out of Auburn University did a study looking at knee injuries in athletes other than weight lifters.

DR ALMEIDA: Is there information only on weight lifters? Have they looked at running or some other activity more comparable to BUD/S training?

MR GOSS: Yes. It was published in *Power Lifting USA*, and then reprinted in another publication.

DR ALMEIDA: Was the study a controlled scientific trial?

MR GOSS: We have an injury tracking system, and I don't know where we have an abundance of weight lifting injuries to the knee...

DR ALMEIDA: Our goal is to produce a BUD/S trainee who is at low risk for injury. We all believe, based on current information, that we can achieve that goal by preconditioning the trainees - improving their levels of aerobic capacity, strength, and endurance. In the medical literature, there are studies which evaluate some conditioning programs' abilities to improve fitness.

MR RYAN: **Commander Morris, I'd like to encourage you to include the single leg squat back into your activities, because if you are going to do one type of squatting activity - at least from my perspective - a single leg squat is a strength builder, it improves core or trunk stability and strength, and is definitely a proprioceptive stressor. So, you are working a variety of things in one exercise as opposed to single tasks for different parameters.**

CDR MORRIS: That sounds good to me. I was doing those from high school, and never had any problems with my knees. So, I was surprised at some point in my professional life to be told that wasn't a good thing to do any longer...but, it went away. But, back to the reason it was recommended in the first place with what Lieutenant Gluck said...was that we are trying to talk about equal preparing. If we can get a better base, like I mentioned earlier, and if bigger bones mean less fractures...and this causes thicker bones...then that might be

oversimplifying the thing, but it brings it to my level, and so all the statistics are of less importance to me at my level when all I know is that I've got less fractures, because I have thicker bones, because I have a better base, because we sent out a thing telling them to do this for 10 to 12 weeks. Does that help? Am I on the right track with that?

DR ALMEIDA: That's the theory, although it has not yet been validated.

DR ANDZEL: **I just want to make a point, too, in the fact that the ACSM recommendation (position statement) for exercise is basically a minimum of 3 times a week for aerobic exercise, twice a week to do resistance training - that's for the average person. We're considering this group to be supposedly above average. Yet, that type of training, as a whole, does not exist except for volunteer individuals that do it on their free time - resistance training. So, to bring yourself into what is supposedly recommended for the average person, it's a natural thing to do.**

CDR MORRIS: That's really a key for our purposes at BUD/S, because we wouldn't have the medical problems if we had a better base of people coming in the front door. Then it might make it easier for them to go through training, and their will might be enough to drive them the rest of the way.

LT GLUCK: In fact, some of them may decide they don't have the time to do this type of training, or go through our mail out, and maybe those people aren't as motivated to become SEALs after all.

CDR MORRIS: That's another measure. At least we'll pick up a few, maybe.

LT GLUCK: Right. So, that's our intention, to make these into better shape candidates when they come in the door. I think that the squat itself is somewhat controversial because of the patellofemoral stress. But, once again, these are not final.

COL ROONEY: **Another point, back in the middle 1980's we did a lot of plyometrics at the Air Force Academy - depth jumping, and those types of things - and we failed to build an adequate strength base prior to doing that. I think a lot of places overdid it. What we found is going back and developing a strength base before we started the plyos eliminated the patella tendinitis and achilles problems that we were creating in our athletes. That's something that I think you'll see. Part of your problem is that you may not have an adequate strength base, and may not be able to go from concentric to eccentric fast enough. If you develop a good strength base using a proper weight training program, you can eliminate some of your injuries.**

LT GLUCK: **Let me just mention some of the other exercises that we recommended: the curl grip, lat pull-down, and bench press. For the lower back exercises, we like the dolphin kick. You lie on the table with your hips over the edge and extend both of your legs against gravity. You can add weights to your feet, if you want to make that a more**

difficult exercise. The other low back exercise is the dead lift with a shoulder shrug, which incorporates the trapezius muscle. It's a straight leg dead lift. How many degrees would you go down with that straight leg dead lift?

MR GOSS: As far as you can, until you can grab onto the bar.

LT GLUCK: When you do the repetitions, do you go all the way back down to the ground, or just partially down?

MR GOSS: Go all the way back down.

LT GLUCK: Okay. We supposed the neck strengthening would be taken care of during calisthenics, so we didn't address that as specifically. You could add additional exercises as time permitted, but we wanted to leave it at 20 to 30 minutes for the workout so that the individual had time to do endurance training, running, or swimming, or whatever they want to do.

Plyometrics...if you are unable to perform a running program -say you are stuck on board a ship (which is not uncommon before coming to BUD/S) you might be able to utilize other mechanisms to increase your endurance and strength. In addition, we would introduce swimming into the running program to increase experience with that exercise.

MR KOCH: **Just a point on the pre-BUD/S if you are on a ship with the plyometrics (jumping). Again, that was to start them getting used to some kind of shock on their feet...a slow progression. If they can't start their running, and you have them go from a ship to just riding a bike (using their aerobic capacity), and then all of a sudden get into the shock of running on the pavement or whatever...we felt that a small plyometrics program which is just jumping (either a cone or whatever) would start the shock going, so they would have some progression again. So, when they came to BUD/S, their ankles and their shins would be prepared for that kind of work.**

MS STONE: **What about jumping rope?**

MR KOCH: **Same thing. That's actually just as good. Excellent idea.**

MR BEETEN: **One of the real easy ways to do that, and you'll find out probably that 40% of the kids can't do it - maybe even higher, is just layout a hop scotch pattern on the floor. You'll find your failure rates really high, and it's a motor coordination thing, and it's a foot movement thing. They are having to rebound from foot to foot, although there is no height progression in it. But, it's a good starting plyometrics exercise.**

MR KOCH: You'll just have to call it something besides hop scotch. It has to be the Death Circuit or something. I don't think you are going to go over big with hop scotch.

MR BEETEN: If you want to find people who can't think with their feet, it's a great test.

COL ROONEY: **We have a hexagon on the floor in our training room, and it's kind of like hop scotch. They just jump to different points, and it doesn't take a lot of room, and it's pretty effective.**

MR KOCH: **It really looks easy until they try to do it. It builds really quick when they get into their unit after BUD/S. That's how you get fast feet. That's agility...that's getting up quick and running, and carrying...they are already setting up for that.**

CDR MOORE: Colonel Rooney, how do you get the guys to go through that? Are they on a set program when they come in?

COL ROONEY: Yes. They are just on a circuit.

CDR MOORE: They're on a circuit, and that's part of the circuit?

COL ROONEY: Yes.

DR FRANCIS: I've heard of a variation called the compass jump. You're bouncing up and down, and you jump North, South, West, East, South, North, East, West...you go around the points of the compass.

CDR MOORE: Is someone calling out the numbers when they're jumping in this hexagon? Or are they just randomly jumping?

COL ROONEY: They have a set pattern that they go through.

MR GOSS: They do three revolutions to the right, three revolutions to the left...as fast as humanly possible.

UNKNOWN: They jump in and out of the hexagon. The USTA uses that too for their upcoming tennis stars.

MS STONE: And US Skiing...

MR BEETEN: Skiing uses it on a vertical platform - you are going from the slope to the flat...

MR GOSS: In football, they have dots. It's a dot drill.

COL ROONEY: It doesn't take a lot of space. If we're talking about a ship or whatever, that's real simple. Plus, Ms. Stone's suggestion of jump roping... there are a lot of things you can do.

MR BEETEN: You can do some phenomenal things with jump roping. We used to use it for a lot of sprint training to increase foot speed. But, pretty soon you are not jumping rope standing still. You're jumping rope running...and eventually you can run at about 75% of full speed while jumping rope, believe it or not...and that's tough. When you can do that you know you have a good sprinter.

LT GLUCK: **The only recommendation we have for BUD/S itself is to incorporate some weight training and plyometric exercises. It could occur during the second and third phase of training when the class size is significantly smaller, and access to weights and plyometric exercises is easier logistically. During pretraining and first phase, with the vast number of trainees, it would be difficult to perform these types of exercises.**

Now on to strength training after BUD/S. Importantly, SEALs should take with them to the Teams proper exercises and techniques learned in training and pretraining at BUD/S. Hopefully, they picked up good techniques and exercises to maintain and further build their strength, endurance, and agility.

We would continue with the periodization technique of strength training after BUD/S, keeping in mind that the body needs to heal intermittently. The running, swimming, and calisthenics will be recommended by the other groups. A statistic we got from the SEAL Team members was that while deployed, they have weight facilities available about 50% of the time. We recommend techniques of strength training without weights, so that they can be performed while deployed, 2 or 3 times per week. While in the garrison, the SEALs should keep up their skills on the exercises that you can do without weights. If you do 2 weight room sessions per week, perform the 3rd weight training session outside the weight room utilizing other objects for weights. Also, plyometric exercises should be incorporated prior to weight training sessions.

Tradition has dictated that all SEAL Team exercises and weight training occurs in the morning. They usually allow from 0730 to 0930 to do their workouts. Following PT they often go on to other skilled technical evolutions. It would seem appropriate to perform those skilled technical evolutions first before fatiguing their muscles...before they do fast roping with fatigued arms...putting themselves in an position where they might get injuries.

Now we go into exercises that can be done in the absence of weights. We emphasize that any of the exercises could be done by just isolating one side of your body and that increases the work involved. For pull-ups, we did like using the locked fingers over a pull-up bar, simulating a particular type of climb that SEALs encounter. You can add a weight belt, ammo belt, or ruck sack to add weight. Squats and calf exercises can be performed while wearing a ruck sack or weight belt. In addition, push-ups wearing scuba tanks is not a bad idea.

CDR MORRIS: You just don't understand how much grief we have taken over jock up drills with tanks on people's backs. It is really interesting how we come full circle on this.

MS STONE: I think some of it is where you actually position the tank. If you position the tank on the upper back, and make sure it stays there or the rucksack or whatever, that's a whole different exercise from letting it slide back on your lower back.

CDR MORRIS: Right, and we were doing jock up drills because people weren't paying attention any longer. We needed to get their attention, so then it becomes the motive. It turns from being one of physical strength or endurance to I want to get your attention. It is misinterpreted as harassment.

BM1 CUMMINGS: I think the key here is progression. You start out with a single 80, then you add a single 80 with a weight belt, and then work up to double 80's. You do that, then you're getting your strength training in there progressively.

DR ANDZEL: **The idea of these alternate exercises was based upon the fact that some of the operators told us that when they're deployed, like in Thailand where there are no weight room facilities at all, they wanted to maintain their strength, what could they do? So, the suggestion was, here are some alternate exercises that you could do to maintain your strength with the equipment that you have while you're out in the field. At least if you are out there for 7 days, and you want to maintain that strength level, you could. In most of the research I looked at that looked at combat and physical fitness parameters, there seems to be (after 5 to 6 days) a loss of strength that occurs being out in combat. So, it would be nice if you could utilize your equipment and maintain that level of strength while you are out there. These are some of the suggestions. Some of you guys might even have other suggestions. These are just suggestions at this particular time.**

LT GLUCK: Any of the exercises can be done with whatever gear you have available, be it a weight belt or rucksack. Shoulder shrugs or upright rows can also be performed with a weight belt or ruck sack for strength training.

We felt that the SDV Teams may have slightly different requirements then the regular SEAL Teams. They may, in fact, need a different physical training and strengthening protocol.

We did discuss a proposed SEAL physical training protocol. Emphasis was placed on the order of different types of exercises as opposed to specific calisthenic or stretching exercises. These will be proposed by other work-groups.

The workouts should begin with ample warm-up exercises. Either jumping jacks or jogging in place for 5-10 minutes until you begin sweating is preferable. Exercises not considered good for warm-up include push-ups, crunches, and low back exercises. Warm-up exercises get the blood flowing prior to doing these more demanding calisthenics.

Warm-up is followed by dynamic stretching and a list of these types of stretches is included with your handout. After this, you can begin calisthenics or plyometric exercises. Calisthenic and plyometric exercises may be interchanged or intermingled as desired. Strength training sessions may be chosen as opposed to calisthenics and plyometrics.

After completing calisthenics or strength training, endurance training can be performed. These include running, swimming, biking, or any combination of these exercises. This must be followed by ample cool-down time to prevent significant lactic acid accumulation in the skeletal muscle. Endurance training should not be concluded with a sudden stop. Finally, the PT session is completed with slow, static stretching.

DR ANDZEL: **I think the point here was that it was brought up before in reference to the flexibility...was the fact that in your warmups, you have to be careful to the fact that you can be too aggressive in your warmups, and produce lactic acid and carry that over into your actual calisthenics. If that's your goal, fine, but basically the idea of a warmup is to enhance the performance that is going to follow. Therefore, you have to be careful that you don't overextend your warmups, and it's not at a great intensity. If it is at a great intensity, studies show that you're going to have to allow for some rest period in between...before you start doing your calisthenics. Basically, the idea here in the warmup, is to warm up your core temperature and your muscle temperature. It takes around 10 to 15 minutes to do it, from a research point of view. Then, we had mentioned the fact that in the cool down, after you finish your run or after you finish your PT, studies have shown that if you want to do less than light continuous exercise, that is going to facilitate the lactate removal from the muscles that you are using. So, we suggest a tapering down, and then finishing up with your static stretching that was named before.**

LT GLUCK: And a technique to make sure that people don't forget to do their static stretches, is to do it in a partner-type evolution, so that your buddy and you have to go through those particular stretches before you can take off and shower, and such...

The last thing is that there can be some continuity in the training in the teams. Provide either an instruction manual and/or possibly a videotape demonstrating proper exercise technique for the SEAL teams to have some kind of sustainment training - so that they could perform these physical training evolutions properly or as recommended.

CDR MORRIS: One of the things that you mentioned reminded me that the skipper at BUD/S is putting together a videotape incorporating some of these kinds of exercises for pre-BUD/S personnel. Then they are required to bring that with their orders, and it into us when they show up. Then we take that tape and send it out with the next guy. That way it doesn't cost us an arm or a leg to continue that program.

MR KOCH: One of the things, I think, that came out of this meeting, and I feel is really important is that we've agreed that strength training helps prevent injury, but the order in which you do things...even the things that you do now, for instance, with the physical training in the morning and the skill work in the afternoon - I think that really may add to your injury problems. It seems that even the guys in the units get used to that, so they say that there is nothing wrong with it. I think there is overwhelming evidence that once you exhaust the muscles, you become more injury prone. We had long conversations on it yesterday, and you can discuss it with these guys. Just the fact of flipping it around, even though it is going to change everybody's lifestyle, you'll see marked increases in their skill levels...and their concentration levels...and their ability to break past certain barriers that maybe they've gotten into...especially as you get older, older meaning from 24 to 28.

CDR MORRIS: In the past we have changed our early morning PT in the Teams, which usually runs right after quarters until 0900 or 0930. We've changed it to a late morning, we've changed it to a first thing in the afternoon - a 1300 to 1430 kind of thing. In some teams, I don't know if they still practice that now or not. We always seem to fall back to the early morning, because we're there at quarters, we get our muster, we go right into PT gear, we get our showers, and then we can go ahead and get on with the rest of our day. Except, of course, for those platoons that are out of the area working on one thing or another, and they fit their PT in whenever they can. What you're suggesting is that we need to do it from 1500 to 1600.

MR KOCH: In sports training, it becomes a convenience thing. The big thing now in training is planning...what's our goal? Is our goal to complete today's comfortably, or is our goal to set up for a long term? Now, a lot of guys will say they can't do as much weight today when they lift, because they do certain exercises. They switch it around, because it makes it more convenient today. What happens is the skills and the long term goals fall off. It's real convenient to get up in the morning, and we deal with it all the time...get up, do your thing, and then go on with your life. What we found is that we can also make it the same at the end of the day, because now you know you're done, you get your workout in, you take your shower, and then you're ready to go home. So, it's almost the same kind of approach, but the long term skills - and in this case the injuries - would be markedly different.

DR FRANCIS: There is just one additional thing that is kind of an interesting concept. That when you are learning a skill, it's best to do it in an unfatigued condition because you're focused on a skill, and you can do it mechanically well. When you get operational, there are some people who believe that if you operationally do a skill in a fatigued condition, then you should practice it in a fatigued condition. That's a very different issue. In other words, if you have to take scuba equipment apart, and you've just had a 10 mile swim, it's very different from if you're fresh. You need to learn how to do it in a controlled manner initially. I think that once you get operational, you might want to think about the switch.

DR ALMEIDA: That's an excellent point. It may be appropriate for SEALs in the teams to perform skills in the fatigued condition. However, for the BUD/S trainees, skills training should be conducted before the trainees are fatigued from their physical training.

CDR MORRIS: Where we see most of the injuries is in the first phase of BUD/S. Our skills there are mostly physical, but the skills are like IBS paddling and some swimming skills in the pool, drownproofing, and things like that. There are not a whole lot of technical skills. They're not working on diving equipment, they're not working with demolitions or weapons, but basically have a paddle and are learning teamwork together to pull through the surf, or what have you...So, the damage that's occurring is probably because, again we go back to them not being ready and/or the mix. I guess we can do IBS surf passage in the morning, and then to PT in the afternoon. Then they wouldn't be too tired in the arms and shoulders to do IBS surf passage...then they might be more ready to do PT in the afternoon. We do mix it around now.

MAJ LILLEGARD: Would it be reasonable to do what you're doing in that first phase, and then do what you're saying...change it so the skill drills are done in the morning during the second and third phase?

CDR MORRIS: Do the dives first.

MAJ LILLEGARD: Just in the second and third, but kind of do the same order as you're doing now. Basically what you are doing is fatiguing these all day with minimal skill. From what I understand, it is not as critical in that first phase to change this. That works with you guys better.

B. STRENGTH WORK-GROUP GENERAL RECOMMENDATIONS

1. CONDITIONING RECOMMENDATIONS

A balanced conditioning program should include four major training elements: (1) warm-up/cool-down (discussed in the previous section), (2) aerobic conditioning, (3) muscle strength, endurance, and power, and (4) flexibility (i.e., stretching; discussed in previous section).

Aerobic Conditioning. Specific aerobic workout guidelines for the NSW community will be addressed at the next Conference scheduled in FY96. Recommendations regarding the duration, frequency, and intensity of aerobic exercise depend on the individual's current levels of fitness and goals. Currently, aerobic fitness routines within the NSW community vary considerably among commands, but all include a variety of running and swimming events (e.g., "Raging Rhino," "Monster Mash," Run-Swim-Run).

Muscle Strength and Endurance. Specific strength workout guidelines for the NSW community will be addressed at the next Conference scheduled in FY96. Some exercises have the potential to develop both strength and endurance, depending on the individual's fitness level. For example, individuals who can only perform a low number of reps will develop muscle strength, while individuals who can perform a high number of reps will develop muscle endurance. In general, calisthenics develop endurance, and high-resistance weight workouts develop strength; however, adding weight to a calisthenic program (e.g., pull-ups or push-ups while wearing a weighted pack) will develop muscle strength. Maximum strength gains are achieved with 3 sets of 6 to 10 reps of high-resistance weight. For muscle endurance, perform 2 to 3 sets of 15 to 30 reps using lighter weights.

NSW operators attending the conference reported that a SEAL team has weight facilities available approximately 50% of the time when deployed. If weights are unavailable, and the SEAL does not train, some strength loss occurs after 5 or 6 days. Therefore, strength training without weights or machines is recommended during deployment. Many exercises can be performed by isolating one side of the body to increase the workload and maintain or develop strength (e.g., One-Sided Push-Ups, One-Legged Squats, etc.).

Operators who have regular access to weights should also keep up their skills on exercises that can be performed outside the weight room. If two weight training sessions per muscle group per week are performed, one session should be performed using other objects for weights. Adding weight to pull-ups, push-ups, squats, and lunges builds strength. In the absence of free weights, a diving weight belt, ammo belt, rucksack, or even scuba tanks (worn supported on the upper back while doing push-ups) provide ample weight for strength building.

While performing pull-ups, the panel recommended locking the fingers over a pull-up bar simulating the type of climbing movement SEALs need for mission performance. Additionally, adding tape to pull-up bars will develop grip strength (see page 67).

Muscle Power. Specific workout guidelines for the NSW community will be addressed at the next Conference scheduled in FY96. Plyometrics (e.g., Lunges, "Bunny Hops," Hopscotch) are an advanced form of exercise designed to develop muscle strength and power by exercising muscles both concentrically (contraction of the muscle while it shortens) and eccentrically (contraction of the muscle while it lengthens). Additionally, plyometrics promote proprioception (peripheral sensory feedback), and are used to prevent and treat exercise-related injuries. On the downside, because plyometric exercises work muscles eccentrically and rely heavily on proper technique, there is an increased chance that an individual performing plyometrics without an adequate strength base, or using poor technique, might develop an injury. Ideally, a proper strength base should be built prior to BUD/S. After developing appropriate strength, plyometrics can then be combined with calisthenics.

All conditioning exercises should be performed following the warm-up period. The panel recommended two evolutions of plyometrics/calisthenics per week. Additionally, two strength workouts *for specific muscle groups* per week on nonconsecutive days were recommended. For example, doing an upper body workout one day and a lower body workout the next day would result in four strength workouts per week. After the plyometrics/calisthenics or strength training session, aerobic exercise can be performed. The aerobic session should be followed by an ample cool-down period. Cool-down exercises should be slow, static stretching to improve recovery and flexibility, and help prevent injury.

PT should be scheduled after skill work in order to optimize performance on skill-oriented tasks without the interference of fatigue. This also decreases the potential for injury during such tasks.

2. PANEL'S RECOMMENDED CONDITIONING PROGRAMS

I. PRE-BUD/S: It was recommended that a training program, including illustrations and descriptive text, be mailed out to prospective students prior to BUD/S training. A pre-BUD/S program should focus on building an adequate strength base to enhance performance and guard against injury. This program should include a 10 to 12 week pyramiding strength and running training program.

A. Strength Training - A strength training program should include the following:

1. 2-3 workouts per week on alternate days
2. Approximately 30 minutes of weight training per session
3. Each session should include:
   a. Dorsi- and Plantar-flexion
   b. Parallel Squats with progressive weights

c. Curl grip lat pull-downs with progressive weights
d. Bench press with progressive weights
e. Lower back exercises could be supplemented with a straight leg dead lift with a shoulder shrug, or the Dolphin Kick (see Appendix A)
f. Neck to be strengthened in calisthenics
g. Additional exercises as time permits
h. Workout lasting 20-30 minutes

B. Muscle Power - Plyometrics should be emphasized and a program undertaken after an adequate strength base has been developed (at approximately week 8). A plyometric training program should consist of two training sessions per week, on nonconsecutive days.

C. Aerobic Conditioning - Aerobic training should be done in conjunction with strength training; however, it should consist of an alternating run/swim program in order to reduce the risk of overuse injury. The stress fracture rehabilitation running program used in the past should be emphasized. This 12-week program substitutes nonload-bearing activities for running during the third week of training. The rest period allows the bones in the lower leg to adapt (i.e., increase in bone density) to the stresses imposed by running which helps prevent stress fractures.

1. Running

a. Every other day for the first 2 weeks
b. Do not run week 3
c. Resume running every other day for the next 9 weeks

2. Other Aerobic Activities

a. Biking or swimming may be used for aerobic conditioning if running is not feasible (i.e., during deployment). A swimming program should include finning (progressing from free swimming to finning) to train the muscles of the feet and calves.
b. Jumping exercises (e.g., jump rope) should be added to provide stimulus necessary to promote bone growth if running is not possible.

II. BUD/S:

A. Strength Training - Training to develop muscle strength should continue through BUD/S when possible. It would be difficult to include these exercises during BUD/S pretraining and first phase because of the large number of trainees. However, strength training could be incorporated during the second and third phase of training when the class size is significantly smaller and access to weights is greater.

B. Muscle Power - Plyometric training should continue through BUD/s training.

C. Aerobic Conditioning - Recommendations for BUD/s were not covered by the work-group.

III. SEAL Workout

A. Warm-Up - A warm-up should always precede an exercise session. Recommendations regarding warm-up and preexercise stretching are provided in the Flexibility Work-Group Recommendations, page 97.

B. Muscle Endurance (i.e., calisthenics) - Two evolutions per week on nonconsecutive days are recommended and may be done in conjunction with plyometrics, strength training, or aerobic training. Static stretches for specific body areas may be performed ("filler" stretches) once the workout for that area of the body is complete; however, a significant drop in exercise tempo should be avoided in order to keep exercising muscles warm.

Note - All calisthenics listed below were recommended by the work-groups and/or the panel; however, not all calisthenics were discussed during the panel's calisthenic review.

1. For a 30-minute workout pick 1-3 exercises from each category.
2. For 60-minute workout pick 3-6 exercises from each category.
3. Balance front with back (flexors with extensors).

a. Neck

(1) Supine Fore and Aft, Prone Fore and Aft, Lying Side to Side
(2) Slow Neck Rotations - do prone, supine, and on each side
(3) Neck Isometrics - push head into hand, do all four directions

b. Shoulders, Arms, Chest

(1) Push-Ups - all varieties; triceps, wide, normal, feet on ground or tilt board
(2) Push-Ups With a Plus
(3) Fingertip Push-Ups
(4) Diamond Push-Ups
(5) Fist Push-Ups
(6) Dive Bombers
(7) Pull-Ups - all varieties (recommend more Pull-Ups than Chin-Ups because Pull-Ups are more task specific.)

(8) Chin-Ups - all varieties
(9) Dips - regular grip
(10) Air Circles (Sun Gods)
(11) Eight Count Body Builders

c. Abdominals

(1) Bent Knee Sit-Ups - do alone, don't hold partner's legs
(2) Bent Knee Cross Over Sit-Ups
(3) Crunches
(4) Vee-Ups - legs remain vertical throughout exercise
(4) Nuclear Sit-Ups*/Helen Kellers*
(5) Side Flex*
(6) Hip Rollers*

d. Back

(1) Trunk Side Stretch
(2) ITB Stretch
(3) Incline Pull-Ups - do on underside of dip bar - feet on ground, back straight (puts body approx. at 45° angle) - use narrow, normal, and wide grips - can use Pull-Up and Chin-Up grips.

e. Hips

(1) Nuclear Sit-Ups/Helen Kellers*
(2) Stomach Pump-Ups*
(3) Jane Fondas*
(4) Inboard/Outboards*
(5) Good Morning Darlings*
(6) Flutter Kicks*
(7) Sitting Flutter Kicks*
(8) Leg Levers*
(9) Seated Knee Benders*
(10) Knee Benders*
(11) Prone Flutter Kicks
(12) Dirty Dogs
(13) Donkey Kicks
(14) The Superman - raise one arm and opposite leg, hold 3-5 seconds - prone and kneeling
(15) Prone Back Extension

f. Legs

(1) Burt Reynolds
(2) Plyometrics (Lunges, Bunny Hops, Side to Sides, Standing Broad Jump)
(3) Hack Squats
(4) Toe Raises - all varieties including with tilt board
(5) Penguin Walks
(6) One-Legged Squat

* **Limit use** of these hip flexor exercises. Increased use has high potential for low back injury. Recommend no more than two of these exercises per 30 or 60 minute workout. Limit to 100 reps total for each of these exercises.

D. Muscle Power - Plyometrics should be emphasized once an adequate strength base has been developed. A plyometric training program should consist of two training sessions per week, on nonconsecutive days.

E. Strength Training - Two strength workouts per week on nonconsecutive days, *for specific muscle groups.*

F. Aerobic Conditioning - Aerobic conditioning may be performed after completing plyometrics, calisthenics, and/or strength training, or, as a stand-alone workout preceded by a warm-up and followed by stretching and cool-down.

G. Cool-Down/Stretch - The cool-down may resemble the warm-up in that it can be a slower version of the activity that was performed (e.g., walking after a run). The cool-down should at least consist of 10-15 minutes of slow, static stretching. (For stretching exercises, see Flexibility Work-Group Recommendations, page 97.)

VI. BIOMECHANICS WORK-GROUP FINDINGS

Work-group members:

Wade Lillegard, MAJ, USA
Peter Francis, Ph.D.
Sandra Almeida, M.D.
Steve Giebner, CDR, MC, USN
Kenton Kaufmann, Ph.D.

A. REPORT OUT

MAJ LILLEGARD: From a biomechanical perspective, we wanted to address three main issues that seem to be the biggest concern with the BUD/S groups... that is, stress fractures, anterior knee pain and retropatellar pain syndrome and iliotibial band friction syndrome. The one we wanted to spend a little more time on is the stress fracture issue. Fred had mentioned, and I fully agree with him in the strength program, there may be something we can do to help prevent that.

First of all, especially for the operators, I'd like to go over just a brief discussion with you of the physiology of bone remodeling. Most of the panelists are in agreement with the basic principle of exercise physiology, and that's the SAID principle (Specific Adaptation to Imposed Demands). In any of the tissues, the bones, ligaments, and muscles are given a demand. They respond to the demand by eventually becoming stronger. When we look, particularly at bone because that's where most of the research is done, there's an orderly pattern with which the bone responds to stresses. So we take any individual, and they have a normal bone essentially...if we look at one cortex, it's at a certain depth...and that's individual. As they stress that bone, it becomes thicker and is able to withstand more stress by becoming thicker. The important thing when it comes to training, from getting from point A (normal bone) to point B (thicker bone), is how do we do that with minimal injury. When you put a stress on a bone, and that stress can be an axial load, a twist, or muscle tension if there is too much stress from any of those components, the bone is going to want to get thicker and it needs to get thicker. So, how does it do that? It gets from point A to point B sequentially. The first thing that happens is it perceives the stress and wants to get stronger. But the first thing it does is send in bone eating cells. So, what it will do in that area of stress is start thinning out because of increased osteoclastic (bone destruction) activity. So, essentially the osteoclasts are excavating the bone, preparing to fill it in to make it thicker. After that bone thinning phase, we have the osteoblastic (bone building) activity which fills that area in and makes it thicker. The sequence or timing of this is what's critical. What we need to know is when is that bone at the thinnest, because when it's thin it's at its highest risk to developing a stress reaction or stress fracture. The only study that has really looked at that was done in 1962 on Marines via bone biopsy with some people who had stress reactions or stress fractures. What they found was this phase (maximal thinning) was at the end of the second week of training. If you use that information, you would say that at the end of the second week of training (i.e., when the bone is at its maximal thinness) is when you need to give that body a break to allow the osteoblasts to come in and fill that out...and then to go on and have a healthy bone without developing those stress reactions and stress fractures.

Indeed this information was taken in 1972 by Colonel Scully down in Fort Bliss, Texas, where he took 7,200 Army recruits, and at the end of the second week of training (this was the only intervention he did), had no load bearing activities - they didn't do any more running, they didn't do jumping jacks, they didn't do any lower extremity strength training...all they did was upper extremity, upper body activity, swimming, and that sort of thing. With that simple intervention, he decreased the amount of stress fractures by 75%.

So, we were going to make some recommendations that are in line with what's already been discussed - that is the periodization principle. We fully agree with the 3 month, pre-BUD/S training program. We picked 3 months...Dr. Almeida has some evidence with the Marines, and correct me if I'm wrong Dr. Almeida, that 3 months of conditioning seems to be a pretty good predictor of those who are going to make it through a rigorous training program. People who have trained only one or two months still have a fairly high incidence of injury. Beyond 3 months it becomes a little bit cumbersome to expect the training candidates to do. We think that's in line with what you guys discussed - a 10 to 12 week program. We would recommend a 12 week program. We still agree with the same recommendations that about 3 to 4 times a week that running is included in that program, and 3 times a week of strengthening exercises. The main thing that we would recommend is in that phase right here (third week) they don't do any weight-bearing activity. They don't do any extensive lower extremity strength training, and they don't do any running. All that they would do would be the regular upper body PT, and ambulation, and swimming, and that sort of thing. So, that's what we would recommend for the pre BUD/S training program in an effort to keep them out of this high-risk phase.

MS STONE: Would you call cycling a weight-bearing activity?

MAJ LILLEGARD: No, we're talking about running with two and a half times your body weight transmitted through the leg. Even Stairmaster would be safer or cycling or swimming...anything like that...no excessive load-bearing activity. Is there any discussion on that one issue or comments on that?

DR ALMEIDA: Yes. Some of your trainee candidates will have been running prior to BUD/S so they won't need this third week off. The recommendation is pertinent for your trainees who have been exercising very inconsistently or not at all.

CDR MORRIS: What I can do in a 3 week pre-BUD/S course is do two weeks of this, third week just do swimming, and just lay off the running all together. Then the fourth week they would start the first week of BUD/S.

MAJ LILLEGARD: That would be in line with that. We don't know how much training your candidates have been doing.

CDR MORRIS: I bring them right off the ship, and I don't know how much they've been doing either.

MAJ LILLEGARD: Right.

CDR MORRIS: They pass the screen test, and I have this unknown screen test. So, right now I'm doing 2 weeks of pre-BUD/S, and then slamming them into a BUD/S class and doing 5 weeks of pre-Hell week, then Hell Week, then they all fall apart. They all fall apart prior to Hell Week actually. So, what I might do better is I might do....3 weeks before

BUD/S starts, I take the same candidate and do two weeks of hard working. Then the third week we kind of take it easy and do some swims, and don't do hop scotch...do jacks...

COL ROONEY: Take the bus to the chow hall.

CDR MORRIS: Take the bus to the chow hall, or march to the chow hall. Then they say OK, you did very good, you did a good job on pre-BUD/S, and next Monday we start BUD/S...

UNKNOWN: Just a couple of things...the operators said that they are currently sending the BUD/S candidates the fracture stress protocol, telling them how to run. That's what that protocol does - tells them to run for two weeks, then take off a week. So, they are getting that, and they can continue that. This also occurs anytime they increase the intensity of exercise rapidly. So, even if they did that, I'm sure that whatever they're doing isn't as much as you start them here. So, it still happens. Even after you start BUD/S, even though they have pre-BUD/S, their intensity jumps up again so it's still good to take the third week...

MAJ LILLEGARD: **That rolls right into the next issue. That is, once they start BUD/S training, they are doing different things (i.e. running in sand) - which are completely different stresses than what they trained. We would also recommend that you continue basically what you're doing with the modifications that have already been discussed for those first two weeks. But, on that third week, do kind of the same thing - none of the running, and if you can substitute more swimming, you can even increase some of the other upper extremity PT.**

CDR MORRIS: ...and IBS...

MAJ LILLEGARD: Right. The idea, again, is just try to minimize the trauma down in here. This is known for bone, and is probably true for ligaments also. So, an indirect benefit maybe decreasing the tendinitis and other overuse injuries.

DR ANDZEL: MAJ Lillegard, the suggestions that you are making are fine, and I think what needs to go along with that is the psychological approach to the training in that the recruits (pre BUD/S) have to be indoctrinated to the fact that if they don't run for that 1 week they are going to keep their cardiorespiratory endurance up, because they're doing an alternate cardiorespiratory exercise. So, the fear of the recruit is, "Hey, if I don't run, I'm not going to maintain this stuff."

MAJ LILLEGARD: Good point! So, we should have an educational component to this packet that goes out...

DR ANDZEL: Right. What we're dealing with is - you're starting to develop a bi-athlete or a triathlete, in a certain sense, with an emphasis on swimming and running.

MS STONE: When you're presenting that program to people, I think you need to "in the off week," which really isn't an off week (but it will be perceived as that) - there needs to be some way to quantify from week two, this is what you're doing, and show them that in week 3 you're doing the exact same things quantity wise...you're just not running. You're taking the running out, but we're increasing this, we're increasing that, so the perception is that it is not a rest week...it is a rest week for your legs.

MAJ LILLEGARD: Right.

UNKNOWN: Call it "swim week."

MR RYAN: The way to do that might be to intersperse non-running on a day or two during the first week, a day or two days the second week, and the third week mandatory use of heartrate monitors.

MAJ LILLEGARD: That would be the ideal situation. Funding might be an issue. They're generally about $120 or something.

MS STONE: So, that the implication is, "...if I'm not running, I'm not conditioning."

MAJ LILLEGARD: Right, this will take away that concern.

MR RYAN: Circulate them around, so you don't have to buy one for every candidate.

MAJ LILLEGARD. Right. Now the other issue is sand running and correct me if I'm wrong...is that done 3 times a week starting day 1 in BUD/S or week 1 in BUD/S? Soft sand running?

CDR MORRIS: We have three runs a week, each week. We start off with a timed run, or one will be a timed run, one will be a speed work run, and the other will be a conditioning run of a longer distance. The timed run is on a hard packed beach, and all the other runs are in soft sand and hard packed beach. They change them up...it depends on which instructor is doing it, and how much soft sand they've had that week.

LT SCHNESE: Timed runs are always in tennis shoes, and conditioning runs are in boots.

CDR MORRIS: The speed work day would be maybe down to the demo pits and back, or maybe a two mile run with the berm hills that you saw... sprints over the top of those. Some of the people ran, so those things being conducted while we were doing our run. So, that's some of the speed work they're doing in the soft sand - up the hill and down the other side.

MAJ LILLEGARD: Basically, two of the runs are intense runs, whether it's the sand or the speed work. It probably would be a good idea to limit, initially in the first two weeks the intense workouts to one per week. I don't know if there is any disagreement...

CDR MORRIS: All three are intense. One is a run for time, and if they don't make those times, then they get performance rolls. They have to complete at least 50% of their timed runs successfully. That's an intense putout. Then, they get a day off basically...a Monday, Wednesday, Friday kind of a thing. They end up with 3 runs during the week. They're all fairly intense. I would say one of those on some weeks, maybe we're going to try to keep the men together, and have kind of formation run - go as fast as your slowest man. However, there are also times when we string those people out. We will put a fast guy in front, and he'll take off as the instructor, and the other instructors will work the group as they stretch out. So, the people that are the best runners actually get a chance to perform, so we're not toning them down to the weakest man in the class. We're actually giving the people who can really perform an opportunity to excel, and the other guys can catch up. We circle up, and everybody catches up, and off we go in the other direction.

MAJ LILLEGARD: Our main concern was starting out with too much sand running or intense workouts, because of the same stressors that are there.

CDR MORRIS: Right. In the first weeks we're starting out with 2 and 3 mile runs. By the fourth week, we're into a 4 mile timed run.

MAJ LILLEGARD: That's a fairly rapid progression.

CDR MORRIS: You're going from the first week into the fourth week having come from 2 to 3 miles to 4 and 5 mile conditioning runs.

MAJ LILLEGARD: Those are fairly drastic increases in the intensity, so again, with the third week off it may help a lot with that. What we were recommending was to limit their sand runs to one the first week, and two the second week. The other issue that we've addressed was that we agree with screening PT test that you have to bring SEALs in...and we recommend that it be done, up front, prior to the 3 months pre conditioning program. Then, prior to actually starting BUD/S, they take a more intense PT test (i.e. your SEALs PRT) to possibly screen out those who haven't done their PT program. Anybody who does what we've been talking about will pass that. Those who haven't may not pass. That might filter out some of the injury prone or less conditioned people...if that's feasible.

CDR MORRIS: We've been playing with that a little bit ourselves, and doing what we call an enhanced screen test just prior to classing them up. Then we get involved with the programs that they need to pass this screen test to get into BUD/S...they pass it, we bring them there- then we say, "Now pass this screen test and you can get into BUD/S." They're not ready for the enhanced screen test kind of thing. So, we feel like we might have been chopping people out when they were misinformed. That was sort of the mentality. We've done it from time to time - we kind of play back and forth with that.

MAJ LILLEGARD: It's certainly hard to do it right now, but if you can institute that gradually, I think that might help out with preventing injuries in the future. The other issue

was the biomechanics and how they relate to stress reactions. Probably, the most common one is people who overpronate (flat feet). When people overpronate, the foot and the heel avert (side of foot turns up and outward) which causes the posterior tibialis muscle on the inside of the shin to do too much work to bring the ankle in and control it. That's why you see most of these boot top type of stress fractures - at least that's the theory. One of the biomechanical factors besides just a regular pronator, that can aggravate that, is if you increase the vector forces about the ankle to cause a more dynamic whipping or eversion of that calcaneus. Certainly, a potential for doing that is when you look at a boot...if you have this fairly deep heel - and especially if you are running on sand in this boot - if you strike perfectly there is no problem...If you have an irregular surface here, and they come down with this same heel...this part strikes in here...that will cause a dynamic whipping action. The deeper the heel is, the quicker the whip. That potentially can cause problems. I understand you are already going with a Hi-Tec® boot....is that correct?

CDR MORRIS: Well, the Hi-Tec® boot is something we have tried again just recently. However, we've done the Hi-Tec® boot in the past, and didn't find it satisfactory. We believe there has been some upgrade to the boot, so we're trying it again.

MAJ LILLEGARD: I guess our basic recommendation, whatever you choose, is try to keep that heel relatively thin. Running shoes are generally pretty thin, but I understand operationally that you can't be doing that. Any sort of footwear that would help - especially with the sand runs. Again, it's not a static issue, it's mainly the way it whips that ankle in and out on the sand runs.

CDR MORRIS: Our hard packed beaches do have a slight slant to them.

MAJ LILLEGARD: That brings up our next issue. On the runs, we would recommend not going out two miles and back two miles, but possibly going out a 1/4 mile, back a 1/4 mile. Then you minimize the repetitive stress - at least the duration of that - in any given direction. The other thing - and we would like the groups' opinion on that - is retro running or running backwards. Which would bring us to the next issue of anterior knee pain. A lot of what we have talked about has already been adequately addressed as far as the hamstring flexibility, as far as the quad work to address the VMO's. You might find this fun as the instructors. What retro running does is activates the quads, yet the knee doesn't bend very far back. The patellofemoral force increases up to 5 to 6 times your body weight with a full squat. Even with running it increases about 3 to 4 times. If you're running backwards, those forces decrease by about 70%. It gives you a very good quad workout, and you'll find out if you do this for a day, the next day your quads are very sore. The other thing it does is eccentrically stress the patellar tendon. Patellar tendinitis is probably a significant problem with the BUD/S trainees. **By eccentrically training - in line with the plyometrics that's been talked about - retro running will just facilitate that, or prehabilitate the BUD/S trainees from getting that. It also eccentrically stretches the achilles. Now, as far as how much work you're doing with that, if you are running at the same speed, you're probably working 20% harder than if you're running forward. It's an excellent aerobic**

conditioning program, and an excellent strength program. It gives eccentric contractions on the patellar tendon, and decreases the patellofemoral reaction force. That's why we would recommend including that, and it would be really interesting if there's any agreement/disagreement with the panel on that issue.

COL ROONEY: We're using it on our ACL rehabs...retro running on a treadmill. I was telling Wade, we did a study a few years ago on retro running. We had a lot of problems - just the general population were running into things, and it's kind of dangerous from that standpoint.

MR KOCH: I've seen it used with sprinters and runners. I think it gets into that because no one has ever done it. It becomes really hard and really confusing. I think it's a really good way to get people confused, and to tire them out.

MAJ LILLEGARD: All we would recommend is a 1/4 mile at a time.

CDR MORRIS: It turns out it's a really fascinating concept to me, because my instructor when I was in training ran backwards more than he ran frontwards. He had a big chaw of tobacco on one side, and a cigar in the other - he was always blowing smoke in our faces, and spitting on the ground. He ran backwards all the time. You always like to think of yourself like some of these other people, so I would always try to run backwards when I was first phase officer with the students. You got into a comfort zone eventually, and you could run backwards really well.

MAJ LILLEGARD: Right, there's a learning curve.

COL ROONEY: Plus, we think it will help the retro patellar pain problems.

MR KOCH: As task specific as they get out of BUD/S, it really helps your agility to be able to maneuver in all those planes.

MAJ LILLEGARD: It does help with your proprioception, because your doing toe running backwards.

DR FRANCIS: We could envision a course along the beach that has flags every 1/8 of a mile. They would run forward a 1/4, back an 1/8, forward a 1/4, back an 1/8, and turn around again. They have to think all the time, they going to react..."some dummy's going to do it wrong." It's a psychological stressor. Occasionally in that, you can use color coded flags or something, then you bring the backward running in...I think the instructors would have a lot of fun with it.

CDR MORRIS: Yes, they are doing a little bit of that in Hell Week during the team relays and things like that. But, it's not a common thing for the students so we'll take a look at that. It's an interesting recommendation.

MAJ LILLEGARD: It's a tool, and if it fits in your toolbox and you can use it, it might be beneficial.

CDR MORRIS: That's what's nice. You guys are telling us what we can do that we might even like to try.

MAJ LILLEGARD: I think the last issue we wanted to address was as part of the screening with the enhanced PRT test, adding a few power components. Not that you would make any decisions on whether to admit them or not, but things like a vertical jump, a standing broad jump, and a timed hop - which is what the Air Force Academy uses. The idea would be to keep a database on all the people entering the program, and then over time (when you have enough numbers), correlate these parameters with who drops out for any reason (medical injury reason). If you could find a good strong predictor, that might be a tool that can be used in the future for qualifying for BUD/S training. These are tests that can be done in about maybe two minutes each.

CDR MORRIS: I didn't catch the first part - is it recommended as part of a screen test?

MAJ LILLEGARD: Initially this is database gathering - in other words, you wouldn't use that information...

CDR MORRIS: Just do it to the people we have as they come in.

MAJ LILLEGARD: Right, and keep record on how they perform, and see if there is a predictor on who can't jump, say 72 cm or something. If that's not too cumbersome, we can actually flush out the details of what would be incorporated in that test. If that would be doable, I think it would be interesting.

DR ALMEIDA: If not, you can add jump height to Dr. Kaufman's biomechanics study. They already do a number of baseline, high tech biomechanical measurements. In the study, several baseline biomechanical measurements are taken on BUD/S trainees. The trainees are then followed prospectively through training, and injury is measured as an outcome.

MAJ LILLEGARD: Whatever is easiest. If it already fits in there, it wouldn't take your time.

DR ANDZEL: **Along with the running mechanics, that is the running itself, they might also think about different running strategies. Instead of doing long, continuous slow runs or fast runs, put in interval sprints and repetition running, where they're going to be working on some of the anaerobic components that are involved with being a successful SEAL.**

MAJ LILLEGARD: **Early on, speed kills. When starting a training program - they start getting a lot of injuries. As they adapt, speed does nothing but enhance, to a limit.**

Generally, about two speed sessions or real intense sessions a week is what most running coaches would recommend. If you would agree with that, usually one long distance run a week is necessary, then a couple of speed sessions, and then everything else you do is gravy. But some time during the program, it would be worth incorporating fun things like Indian runs where people are running in a line, and the back guy sprints to the front, then everyone else follows, and they keep doing that.

CDR MORRIS: That's one of the things that we have. In those three runs that I described earlier - the timed run, the speedwork run, and the long distance run - was Indian runs, berm sprints...

MAJ LILLEGARD: They're actually wonderful training modalities. It's just that the timing may be a little bit early. We're thinking of musculoskeletal conditioning as well as cardiovascular conditioning. They may be in good cardiovascular shape, but with that type of surface, the musculoskeletal system needs time to adapt.

CDR MORRIS: There is no third week layoff. We're not doing that. That may be causing some of the damage.

MR BEETEN: Major Lillegard, relative to your comments on speed, the same is true for plyometrics. The same considerations that are applied to speedwork, should be applied to plyometrics. They are incredibly taxing, overloading the system - interspersed is fine, but consecutive days can be dangerous.

MR KOCH: **Our one concern in the group which wasn't put here goes along with the plyometrics and the sprint work. In the SEALs' training, they find new things, and keep adding them to the old things instead of becoming more task-specific. Like this long run thing...it's built into your system. The question came up with everybody we talked to...why is this long run still included, when everybody you talk to that are in the field says, "We never go out and run these long distances; we either walk or we're sprinting." Long swims take care of all that aerobic conditioning. A lot of the groups seem to be adding the short sprints, because one person said "The only sprinting we do is 7 seconds...up and down." That's your plyometrics and that's your sprint work. But, the tradition is you still have to go on these 10 mile runs, which now takes up the time that these things could be put in. I think that after BUD/S, especially, the task specific of each group should be looked at, and maybe from the top would have to say, "Let's make some changes," so that the groups can add these plyometrics and sprint runs, and become more task specific with what they're doing.**

MAJ LILLEGARD: I agree with you on that, Mr. Koch. The only plug I would put in for an endurance run, is that it's a good mental stressor - that you know you can do that. It's hard.

MR KOCH: There seems to be that you have to put two or three long runs in a week, then when you start getting guys educated and they start saying they need this sprint work and this plyometric work, to add it to the top of that.

MAJ LILLEGARD: I agree. You don't need three. I would recommend one long run, and then at least two intense runs.

MR KOCH: Your swim is still going to be a non-shocking aerobic activity, where you get the benefits of aerobic training.

UNKNOWN: What is the longest you do run?

CDR MORRIS: A 14-mile run. That's in third phase. We just do it once. In the teams (early on) there wasn't long distance running. We were doing 4 mile timed runs, and that seemed to be more than what the general public was doing. Then the general public, from the '60s through the '70s and '80s, got into this marathon stuff, then triathlons. So, the teams said, "We can't let the civilians be better than us!". Of course, they naturally gravitate towards these kind of physical things anyway. They end up in triathlons and marathons, and things of that nature. Why? They personally like to do it, and that of course reflects in their team PTs. In the teams, they don't go 14 miles during a team PT.

BMCS NEHL: What do you consider a long run? Is 4 miles long? It might be long for some people, but for other people it might be a short run. This morning, in my team, we did 7 miles. We don't ever do any more than that. 6-7 miles is pretty much the cut off. We do it on a Friday, after a culmination of a week's worth of different PT that we try to vary - runs, swims, calisthenics, and all that stuff. We don't do it every Friday. This Friday we did 7 miles, last Friday was only about 6 miles, then the Friday before that we did a long run, long swim (4-mile run, 2-mile swim). Long runs, 14 miles, we never do them - mostly because of the time they take.

MS STONE: I think maybe you hit on it right there when you said time. Instead of focusing on distance covered, we're going to do an aerobic workout - it doesn't matter whether it's bike, swim, run - and it's going to be 50 minutes long. We're going to do it at such and such pace.

BMCS NEHL: We have an hour and a half. In just about all the teams, from 0730 right after quarters, we go right into PT, and we have to ready to go to work by 0900, 0915, 0930 at the latest - depending on the day.

MS STONE: I think people get hung up on distance.

CDR MORRIS: We do those things because they're fun. We do a Monster Mash because it's fun. We do an Otay run around Otay Lakes, 10 miles, because it's a good time. Those are the kinds of things that get you involved in a team function.

MS STONE: I think one of the other things - and this is talking more about the operators again - is if you have someone who for some reason is unhealthy and can't run, then you can equate (if you work time wise) run to bike, bike to swim. You can say, "We're going to run for 50 minutes. I know what my heartrate needs to be. I'm going to ride for 50 minutes..." One thing that we discussed which didn't come out here is to have a group of stationary bikes, so if you're running out on the beach, take some plywood out there, roll the bike out on the beach, and one of your team members is out there on the beach with you - not running with you, but cycling with you. Or, get a mountain bike out there. Ride on the beach on your mountain bike.

UNKNOWN: I could see the rationale for the 14-mile run.

CDR MORRIS: The 14-mile run is at BUD/S...

UNKNOWN: Right. I could see that rationale, because it goes along with the overall rationale of the BUD/S training program (i.e., to select people who have mental toughness). If you ever did endurance running, there's a mind set that goes along with that toughness. Running 4 miles has a certain mind set, running 10 miles has a certain mind set...if you ran a marathon, getting to that 18 mile mark, you know you have to gut it out. When you finish the marathon, it's the greatest thing in the world. There's a mind set that goes along with all this endurance running, and I think the theme of BUD/S is developing this type of mind set. I can go on with that, culminating a part of BUD/S because it goes along with the entire aspect of what you're trying to do there in BUD/S.

BM1 CUMMINGS: That's exactly right. Once you do the runs and things, when you start getting tired, instead of thinking "I might quit," the first thing that comes into your mind is "No way in hell I'm going to quit until I get to the finish or until this is accomplished." That's what the long runs do. They develop not only physical endurance, but mental endurance. So, there's probably no way that's going to go away. You keep that in there once a week or so in the teams. In my team, we do 8 to 12 on a Friday with maybe a mile or 2 swim on a Monster Mash. Time is extended for that PT period, because it builds that camaraderie thing. After you finished, people want to know where they've placed, because there's a lot of competition in the teams. It keeps you on a racer's edge, so to speak.

MR BEETEN: I really would hate to see the distances thrown out, from a practical standpoint. As an old coach, I'll tell you of an experiment that I did one year. I decided that our distance runners were all covering too many miles, and I thought it was a little redundant, it took a lot of time, etc with 70 to 80 miles a week. So, I decided to reduce them to 35 to 40 miles a week, go with the new training principles of doing shorter, more intense intervals. Then I would have a faster distance runner that would run those increased distances faster. The end result that I got throughout most of the entire course of the entire season, was perfectly lousy performances, increased times, and one good event per year...and, I never knew when it was going to happen. So, what I got as an end result was this one great performance that disappointed me, because it usually came at the wrong time. In terms of a

training technique - yeah, I saved their legs, I did this, I did that - they started to doubt whether they could run that far or not. It took me about two years to get my program back together after I decided we could be an interval based distance team. We had to go back to longer distances, and repetitive times to have any kind of consistent success. So, I would hate to see the distances thrown out. I think to step them up, as you said, from two miles to three miles to four miles to seven, to get a 15 mile performance - that's natural progression and you have to do it.

MR GOSS: You also have to keep in mind that any aerobic training that you do is going to compromise your strength and your speed, so you have to periodize it.

MR BEETEN: I'm not sure if you're on a mission like they're on, you want to get as many people to the front as quickly as you can, to get the maximal numbers there. The idea is not to get two sprinters there, and leave your group of 30 behind.

CDR MORRIS: In a lot of the team PT, we get men who will work-out on their own, and they will lift in the weight room later in the day. So, there is just a hum of activity over there. You don't notice it so much when you're in the team. It's when you go outside the teams into another community, then come back. It's just phenomenal, the amount of physical activity that's taking place. These guys are doing it on their own. The team has an hour or so for it each day, but then they do it themselves...they can't help themselves.

MR GOSS: I just don't want to confuse work capacity (short-term, high intensity activity) with aerobic fitness.

CDR MORRIS: I think we're understanding that.

DR ALMEIDA: One final comment. We've mentioned this periodically, but it's probably a factor that needs to be remembered. No matter what changes we make, the trainees will still shuffle 5 to 6 miles a day back and forth from the chow hall. We're talking about the trainees ramping up from 2 to 3 miles, when in actuality, they're ramping up from 8-9 miles to 10-11 miles. I don't know what can be done logistically, but it needs to be considered.

LT SCHNESE: On this side of the base they march, and once they're on the other side they run.

CDR MORRIS: We've been going back and forth with very similar kinds of recommendations through the years about how we have this extra distance that we're covering. So, on our piece of paper here, it shows us doing 13 and 14 miles a week. Just add 6 miles everyday...

LT SCHNESE: One of the things that we've looked at...schedule things like a pool evolution right after a run. That way they're not running back and forth. That completely cuts out one of those iterations, but, that's how we try to limit that also.

DR ALMEIDA: I think the chow hall movement is going to confound any changes you make to reduce injuries.

CDR MORRIS: Right now, if they're marching or walking on this side, well then maybe we've answered that problem. Maybe that's the trade off that we've done - takes a little longer to get to chow, and it compresses the schedule a little better, and it spoils the mystique of we run everywhere we're supposed to go. Maybe that's a compromise...

DR ALMEIDA: I'm not sure if marching is much better than the shuffle. It would depend on the marching technique.

MAJ LILLEGARD: If we're thinking primarily the boot top type of injuries, their stress reactions...marching much better for that. There are increased stresses other places, but if that's the main concern, I would vote for that change.

CDR MOORE: My compliments to the panel again. You put a lot of effort in. They had to chase you out of here. The ladies with the keys literally came by and pushed some groups out the door. This has never been done before - this type of group. This is history in the making in the Navy. I hope that you take away from this week some images that are burned in your mind in terms of what these people do. We hope to call on you again. I'm sure that you're going to be requested to sit on another panel. Again, on behalf of the SEALs, and on behalf of sports medicine and musculoskeletal medicine in general in the Navy, I thank you all very much.

B. BIOMECHANICS WORK-GROUP RECOMMENDATIONS

I. Injury Prevention

A. Pre-BUD/S

1. Candidates should begin a preconditioning program at least 3 months prior to arrival for BUD/S training. (A Pre-BUD/S program is provided in the Conditioning Programs section of this document.) In addition to conditioning, this program should emphasize the importance of reporting any undue pain or discomfort to a medical officer facilitating proper treatment prior to reporting for BUD/S.

2. An additional recommendation included developing a more stringent physical qualifying test to better assess the probability of completing BUD/S training.

B. BUD/S and SEAL Training

1. Once candidates start BUD/S training, they are exposed to different training stresses (e.g., soft-sand running). The panel recommended that the training schedule for the first two weeks of BUD/S continue (with the modifications that have already been discussed), but during week 3 of training, substitute swimming for running. This would allow time for the bones in the lower extremities to adjust to the new training stresses. Providing a break from running during week 3 provides a chance for bones to lay down a thicker bone matrix which helps to prevent injuries. Other upper extremity PT may be increased during this week.

2. The recommendation for running was not to shorten running distance, but rather, to shorten the distance run in one direction. Changing directions frequently reduces the duration of a repetitive stress on the lower extremities.

3. Retro-running (running backwards), in conjunction with plyometrics, was also recommended. Reto-running activates the quadriceps muscles without stressing the knees. When running forward, the force on the knee is up to four times your body weight. Alternatively, running backwards, **decreases** this force by 70%. Therefore, Retro-running provides both an aerobic and strength workout that prevents injury rather than contributing to it (unless you run into a pole while running backwards). The benefits of retro-running are summarized in the following:

   a. Provides a good aerobic workout. Running at the same speed, you are working approximately 20% harder than when running forward.

b. Provides an excellent strength workout for the quadriceps without the stresses on the knee you get from most quadriceps workouts.

c. Eccentrically stresses the patellar tendon, a tendon which plays a major role in the development of many overuse injuries (e.g., anterior knee pain, patellar tendinitis). The eccentric stress provided by retro running protects against the development of these types of injuries. Retro- running is also used in many rehabilitation programs such as those used in the recovery of anterior cruciate injuries.

d. Eccentrically stresses the Achilles tendon thus protecting against Achilles tendinitis.

II. Recommendations for Prevention of Anterior Knee Pain

Patello-femoral Pain Syndrome (anterior knee pain) is a common overuse injury which frequently occurs in SEAL trainees. This diagnosis represents a spectrum of etiologies (causes) which often can not be definitely determined. Arthroscopy, if performed, can be helpful in determining the source of pain. Symptoms consist of widespread pain in the knee joint during exertion, load-bearing, or sitting with bent legs for long periods of time. Treatment generally consists of rest, patellar (knee) bracing, anti-inflammatories (e.g., Motrin, Ibuprofen), quadriceps training, and occasionally, arthroscopic surgery. Patello-femoral Pain Syndrome is commonly mistaken for chondromalacia patella (damage to the cartilage on the inner surface of the patella) which can only be properly diagnosed by arthroscopy. Preventive measures for Patello-femoral Pain Syndrome are outlined as follows:

A. Incorporate Eccentric Training

1. Negatives, plyometrics
2. Retro-running, 1/4-1/2 mile per week initially
3. Lunges

B. Emphasize vastus medialis obliques use during regular PT activity. The following recommendations can help:

1. External rotation of feet during flutter kicks and lunges
2. Incorporation of lateral leg movements during PT

C. Emphasize appropriate flexibility.

III. Recommendations to Prevent Iliotibial Band Syndrome

Iliotibial Band Syndrome (ITBS; Runner's Knee) is another common overuse injury associated with running frequently diagnosed in SEAL trainees. Pain occurs when the

iliotibial band on the lateral side of the knee becomes inflamed with repeated flexion and extension. This injury is usually treated with ice in the acute phase, followed by local heat, knee bracing and rest, a stretching program, and oral anti-inflammatories. Phonophoresis using hydrocortisone and oral anti-inflammatories is an alternative treatment. Preventive measures are outlined in the following:

A. Alternate direction of running every quarter mile if running on a circular track. Avoid running downhill and/or on the side of the road. Increases in running intensity (speed) and mileage should occur gradually.

B. ITBS Stretch

C. Ice with onset of pain.

VII. APPENDIX A - ADDITIONAL RECOMMENDED EXERCISES

1. INCLINE PULL-UPS (Upper back muscles)

This exercise is basically a pull-up at an angle and requires a low bar (i.e., a dip bar). While lying or sitting on the ground (depending on how low the bar is), grab the bar with both hands and pull the upper body toward the bar at a 45° angle. Emphasis should be placed on pulling together the shoulder blades during the movement.

2. THE SUPERMAN (Hip Extensors)

This exercise helps develop balanced strength between the hip flexors and hip extensors. It can be performed either lying prone or on hands and knees. The opposite arm and leg (right arm, left leg) should be lifted and held for a count of 3-5 seconds, then slowly lowered. Then the other arm and opposite leg are raised, held, and lowered. This exercise is very safe, looks easy, but can burn after awhile. Difficulty can be increased by adding weights to the arms and legs. In the kneeling position, the leg should not be raised higher than the hip.

3. DONKEY KICKS (Hip Extensors)

On hands and knees, extend one leg out and behind then bring it back. This movement should be repeated using the same leg until a burn in the hips and lower back is felt. The opposite leg should then be worked out. This exercise may be combined with Dirty Dogs. The same leg would be lifted to the side and returned, then extended behind and returned.

4. DOLPHIN KICKS (Hip and Back Extensors)

Using something to support the upper torso, this exercise begins from a prone position. Both legs are then raised and lowered until a burn is felt in the lower back.

5. BURT REYNOLDS (Hip Adductors)

This exercise is beneficial for rock climbing. Lying on your side in a straight line, the top leg should be bent and placed just in front of the knee of the opposite leg. The straight leg is then raised and lowered until fatigued.

6. PLYOMETRICS

Due to lack of time, these exercises where not discussed separately; however, the following recommendations were made regarding their use. Plyometrics should be performed only after the body is warmed up. While performing lunges, the knee cap should not get in front of the big toe. When it does, the knee angle is greater than 90°. Going beyond an angle of 90° places undue stress on knee cartilage and ligaments. Additionally, the knee should always be over the heel as opposed to either side. The step should be straight forward and not to the side.

For all exercises, the number of repetitions should be limited according to deterioration of technique. When your technique with one exercise begins to fail, you should change to another exercise (e.g., from "lunges" to "bunny hops" or "side to side") and come back to that exercise later. Slowing the count or cadence can also help offset fatigue.

7. ONE-LEGGED SQUAT

This exercise is good when there is no equipment or weights available. When doing one-legged squats, or any squat exercise, the squat should be performed until the upper portion of the legs are parallel to the ground. Anything lower places excessive stress on the knee.

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13. ABSTRACT *(Maximum 200 words)*

The first Naval Special Warfare (NSW) Sports Medicine Conference, held 4-6 May 1994, was initiated as a Naval Health Research Center research project in collaboration with the Department of Sports Medicine, Naval Hospital Camp Pendleton. The Conference was convened to review the NSW calisthenic program and identify exercises that were likely to cause injury.

Representatives from the United States Olympic Committee, San Diego State University, United States Air Force Academy, Naval Medical Center San Diego, Naval Hospital Camp Pendleton, San Diego Children's Hospital, and Applied Futuristics composed an expert panel of sports medicine and exercise science specialists. Panel members reviewed NSW calisthenics and provided recommendations to improve both the safety and quality of NSW physical training.

This document is an edited transcript of the 3-day Conference. It includes: a section on the epidemiology of musculoskeletal injuries among NSW candidates and SEAL operators; a narrative of the panel's review of NSW calisthenics; recommendations on stretching, conditioning, and injury-prevention; and the panel's general recommendations regarding strength and conditioning programs.

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